Of this issue more than 4000 copies were printed

The Welding Engineer

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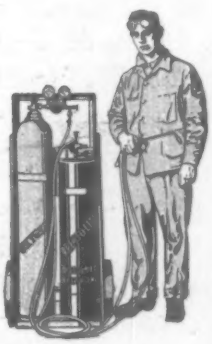
Oxy-Acetylene Welding and Cutting

This process will pay big profits—opens up a wider field for welding



In every shop and factory where welding is done, there is a place for the Prest-O-Lite Oxy-Acetylene Process. Other welding methods pay you a good profit, perhaps, but there is a vastly wider range of work that can be handled efficiently and economically by the Prest-O-Lite Process—in many cases, work that no other method can touch.

In all kinds of metal joining—whether manufacturing, repair or construction work, the oxy-acetylene process has wonderful possibilities for increased savings. It is not in any sense a one-purpose equipment—the entire outfit is portable—ready at all times for use at any point inside or outside the shop where welding is to be done.

The advice and assistance of our Welding and Engineering departments are at the disposal of Prest-O-Lite gas users at all times.

Write us for special literature and data

The Prest-O-Lite Co., Inc.

The World's Largest Makers of Dissolved Acetylene

U. S. Main Office and Factory, 851 Speedway, Indianapolis, Ind.
Canadian Main Office and Factory, Merritton, Ont.

Prest-O-Lite PROCESS

*Alphabetical Index to Advertisers and Buyers' Index, Page 4.

The largest makers of Oxy-Acetylene Welding and Cutting Equipment and Supplies in the World

Oxweld Equipment includes Acetylene Generators, Welding and Cutting Blow Pipes, Regulators and Supplies—everything needed for all requirements—complete installations for the most extensive manufacturing and repair operations to portable units for emergency and field use. Because of the scientific accuracy and exactness of design—high quality materials and the mechanical perfection of construction and workmanship, **OXWELD EQUIPMENT** will produce the most efficient and economical results in welding and cutting operations of every character.

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Our knowledge and experience, as the largest makers of welding and cutting equipment in the world, are always at the service of every purchaser and prospective purchaser of **OXWELD APPARATUS,** to determine the most economical and efficient applications of the **PROCESS** to the manufacturing or repair problems at hand.

Write us for information on any class of Welding or Cutting Work

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NEWARK, N. J.
6460-680 Frelinghuysen Ave.

LOS ANGELES
654-656 Pacific Electric Bldg.

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CUTTING OUTFITS

OXY-ACETYLENE WELDING
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APPARATUS
DAVIS-BOURNONVILLE CO. N.Y.

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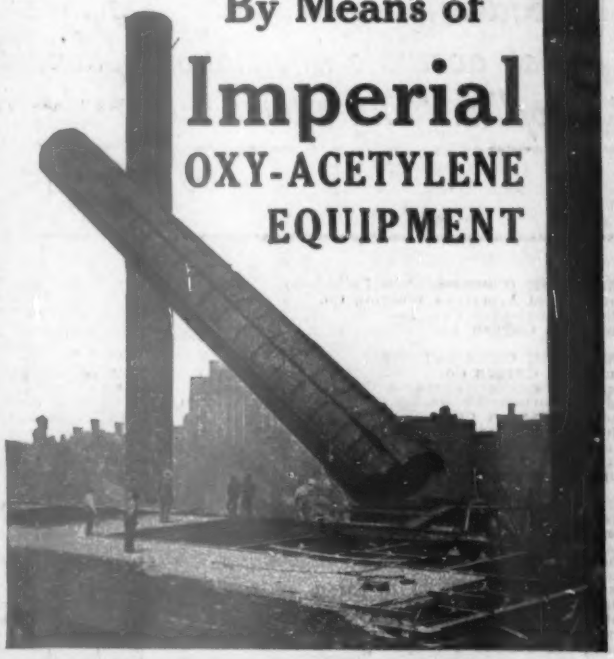
By Means of

Imperial
OXY-ACETYLENE EQUIPMENT



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OXY-ACETYLENE PROCESS

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ACETYLENE (Compressed in Cylinders)
Commercial Acetylene Welding Co.
The Prest-O-Lite Co., Inc.
Universal Oxygen Co.

ACETYLENE GENERATORS
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Bermo Welding Apparatus Co.
Davis-Bournonville Co.
Indiana Oxygen Co.
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Metals Welding Plant
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.

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Bermo Welding Apparatus Co.
Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
Indiana Oxygen Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co.
Superior Oxy-Acetylene Mach. Co.
United States Welding Co.
Universal Oxygen Co.

ALUMINUM FLUX
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Bermo Welding Apparatus Co.
Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
Indiana Oxygen Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Universal Oxygen Co.

ALUMINUM SOLDER
National Solder Co.
So. Luminum Mfg. & Eng. Co.

ANNEALING FURNACES
Buffalo Dental Mfg. Co.
Universal Oxygen Co.

APRONS (Asbestos)

ASBESTOS GLOVES

ASBESTOS SHEET PAPER
American Oxygen Co.
Davis-Bournonville Co.
Indiana Oxygen Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Universal Oxygen Co.

BLOW TORCHES (Acetylene)
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Bermo Welding Apparatus Co.
Buffalo Dental Mfg. Co.
Indiana Oxygen Co.
Metals Welding Plant
The Alexander Milburn Co.
The Prest-O-Lite Co.

BOOKS (Relating to Welding)
The Welding Engineer

BRASS AND BRONZE FLUX
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Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
Indiana Oxygen Co.
United States Welding Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co.
Superior Oxy-Acetylene Machine Co.
Universal Oxygen Co.

BRASS SPELTER WIRE
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Indiana Oxygen Co.
Universal Oxygen Co.

BRAZING OUTFITS
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Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Universal Oxygen Co.

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Thomson Electric Welding Co.

CARBIDE (Calcium)
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Union Carbide Sales Co.
Canada Carbide Sales Co.

CARBON REMOVING TORCHES
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The Bishop-Babcock-Becker Co.
Davis-Bournonville Co.
General Welding & Equipment Co.
The Harris Calorific Co.
Henderson-Willis Welding & Cutting Co.
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Indiana Oxygen Co.
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The Prest-O-Lite Co., Inc.
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Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
Indiana Oxygen Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Universal Oxygen Co.

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Westinghouse Electric & Mfg. Co.
General Electric Co.

ELECTROLYTIC OXYGEN PLANTS
Universal Oxygen Co.

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Indiana Oxygen Co.
United States Welding Co.
The Prest-O-Lite Co.

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Indiana Oxygen Co.
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The Prest-O-Lite Co.
Superior Oxy-Acetylene Machine Co.
Universal Oxygen Co.

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Bermo Welding Apparatus Co.
Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
Indiana Oxygen Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Universal Oxygen Co.

FILLER RODS (Vanadium Steel)
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Bermo Welding Apparatus Co.
Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
Indiana Oxygen Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Universal Oxygen Co.

FIREPROOF PLASTIC
Bermo Welding Apparatus Co.

FLUE WELDERS (Electric Resistance)
Thomson Electric Welding Co.

FLUX WELDERS (Electric)
Westinghouse Electric & Mfg. Co.

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Universal Oxygen Co.

GASOLINE PREHEATING FURNACES
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Superior Oxy-Acetylene Machine Co.

GAS BURNERS (Preheating)
Superior Oxy-Acetylene Machine Co.
Universal Oxygen Co.
Westinghouse Electric & Mfg. Co.

GLOVES (Asbestos)
United States Welding Co.

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William C. Adams.
Bermo Welding Apparatus Co.
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Davis-Bournonville Co.
F. A. Hardy & Co.
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Indiana Oxygen Co.
Julius King Optical Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Universal Oxygen Co.
Westinghouse Electric & Mfg. Co.

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Indiana Oxygen Co.
Oxweld Acetylene Co.
Universal Oxygen Co.

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Bermo Welding Apparatus Co.
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Operative

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The Helmet is constructed throughout of ***black fibre,*** which is a non-conductor of electricity and much cooler than any other material that can be used, is very rigid and weighs ***but twenty-three ounces complete with the lenses.***

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Superior Oxy-Acetylene Mach. Co.

OXYGEN (Compressed in Cylinders)
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Indiana Oxygen Co.
The Linde Air Products Co.
Swift & Co.
Universal Oxygen Co.

PIPE WELDING
Goldschmitt Thermit Co.

PHOTOGRAPHS
Chicago Architectural Photographing Co., (Specialists in photographs relating to the welding industry)

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PRESSURE GAUGES
American Oxygen Co.
Indiana Oxygen Co.
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Bermo Welding Apparatus Co.
The Bishop-Babcock-Becker Co.
Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
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The Prest-O-Lite Co.
Superior Oxy-Acetylene Machine Co.
U. S. Gauge Co.
United States Welding Co.
Universal Oxygen Co.

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American Oxygen Co.
Indiana Oxygen Co.
Oxweld Railroad Service Co.

REGULATING VALVES (Acetylene)
American Oxygen Co.
Indiana Oxygen Co.
The Bastin-Blessing Co.
Bermo Welding Apparatus Co.
The Bishop-Babcock-Becker Co.
Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
The Prest-O-Lite Co., Inc.
United States Welding Co.
Universal Oxygen Co.

REGULATING VALVES (Hydrogen)
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Indiana Oxygen Co.
The Bastin-Blessing Co.
Bermo Welding Apparatus Co.
The Bishop-Babcock-Becker Co.
The Prest-O-Lite Co.
The Imperial Brass Mfg. Co.
International Oxygen Co.
K-G Welding & Cutting Co.
Superior Oxy-Acetylene Machine Co.
Universal Oxygen Co.

REGULATING VALVES (Oxygen)
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Bermo Welding Apparatus Co.
The Bishop-Babcock-Becker Co.
Davis-Bournonville Co.
The Imperial Brass Mfg. Co.
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Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Universal Oxygen Co.

SCHOOLS OF WELDING
Michigan State Auto School.

SEAM WELDERS (Electric)
General Electric Co.
Westinghouse Electric & Mfg. Co.

SEAM WELDERS (Electric Resistance)
Thomson Electric Welding Co.

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Thomson Electric Welding Co.

TANK CONNECTIONS (Oxygen and Acetylene Adaptors)
Superior Oxy-Acetylene Machine Co.

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The Thermalene Co.

THERMIT WELDING
Goldschmidt-Thermit Co.

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The Imperial Brass Mfg. Co.
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The Prest-O-Lite Co.
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TORCHES (Oxy-Acetylene Cutting)
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Indiana Oxygen Co.
Bermo Welding Apparatus Co.
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Davis-Bournonville Co.
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The Prest-O-Lite Co., Inc.
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The Thermalene Co.
United States Welding Co.
Universal Oxygen Co.

TORCHES (Oxy-Acetylene Welding)
American Oxygen Co.
Indiana Oxygen Co.
Bermo Welding Apparatus Co.
The Bishop-Babcock-Becker Co.
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The Harris Calorific Co.
Henderson-Willis Welding & Cutting Co.
The Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
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The Prest-O-Lite Co., Inc.
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The Thermalene Co.
United States Welding Co.
Universal Oxygen Co.

TORCHES (Oxy-Hydrogen Cutting)
American Oxygen Co.
Indiana Oxygen Co.
Bermo Welding Apparatus Co.
The Bishop-Babcock-Becker Co.
Davis-Bournonville Co.
General Welding & Eq. Co.
The Harris Calorific Co.
Henderson-Willis Welding & Cutting Co.
The Alexander Milburn Co.
The Imperial Brass Mfg. Co.
Metals Welding Plant
Oxweld Acetylene Co.
Superior Oxy-Acetylene Machine Co.
Universal Oxygen Co.

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Davis-Bournonville Co.
General Welding & Eq. Co.
The Harris Calorific Co.
Henderson-Willis Welding & Cutting Co.
Metals Welding Plant
The Imperial Brass Mfg. Co.
The Alexander Milburn Co.
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United States Welding Co.
Universal Oxygen Co.

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The Bishop-Babcock-Becker Co.
The Harris Calorific Co.
Superior Oxy-Acetylene Machine Co.

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The Prest-O-Lite Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Universal Oxygen Co.

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Indiana Oxygen Co.
The Bastin-Blessing Co.
International Oxygen Co.
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WELDERS' GOGGLES
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William C. Adams.
Bermo Welding Apparatus Co.
Davis-Bournonville Co.
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Julius King Optical Co.
Oxweld Acetylene Co.
The Prest-O-Lite Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Universal Oxygen Co.

WELDING (Oxygen for)
American Oxygen Co.
Indiana Oxygen Co.
International Oxygen Co.
The Linde Air Products Co.
Universal Oxygen Co.

WELDING TORCHES (Oxy-Acetylene)
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Indiana Oxygen Co.
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The Bishop-Babcock-Becker Co.
Davis-Bournonville Co.
General Welding & Eq. Co.
The Harris Calorific Co.
The Imperial Brass Mfg. Co.
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The Alexander Milburn Co.
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The Thermalene Co.
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Universal Oxygen Co.

WELDING TORCHES (Oxy-Hydrogen)
American Oxygen Co.
Indiana Oxygen Co.
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Buffalo Dental Mfg. Co.
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General Welding & Eq. Co.
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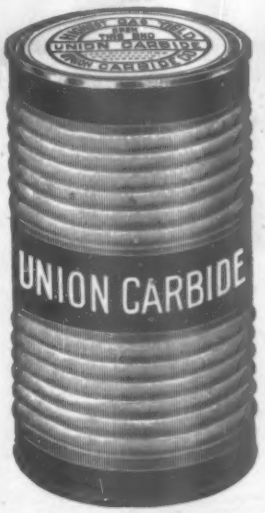

Packed in Blue and Gray Drums

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SOLE DISTRIBUTORS OF

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"World's Best Quality—Highest Gas Yield"

For Oxy-Acetylene Welding Plants

Contractors' Flare Lights, Torches and Private and Municipal Lighting Plants

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$\frac{1}{4}$ x 1/12 in. —finely crushed size.

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Phoenix—16 S. Central Ave.
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Fort Smith—109-123 So. Ninth St.
CALIFORNIA
Eureka—109 Second St.
Fresno—932 H St.
Los Angeles—639 Gibbon St.
Sacramento—1523-31 Front St.
San Diego—326-336 Fifth St.
San Francisco—Kohl Building.
COLORADO
Denver—Nineteenth and Wazee Sts.
Victor—Third and Diamond Sts.
CONNECTICUT
Hartford—877 Main St.
DISTRICT OF COLUMBIA
Washington—Maryland Ave. and 9th St., S. W.
FLORIDA
Jacksonville—106 E. Forsyth St.
Tampa—413 Tampa St.
GEORGIA
Atlanta—Cor. Haynes and Rhodes Sts., P. O. Box 1594.
Savannah—Ogeechee Canal, South of Bay St., P. O. Box 73.
ILLINOIS
Chicago—Peoples Gas Bldg., Michigan Blvd.
Decatur—133-147 W. Williams St.
East St. Louis—600 Walnut Ave.
Peoria—721-731 So. Washington St.
Marion—315 S. Granite St., Box 747.
Monmouth—601 S. First St.
Quincy—232 S. Eighth St.
Streator—702 East Elm St.
INDIANA
Evansville—1601 Illinois St.
Indianapolis—110-112 S. Alabama St.
Terre Haute—921 Wabash Ave.
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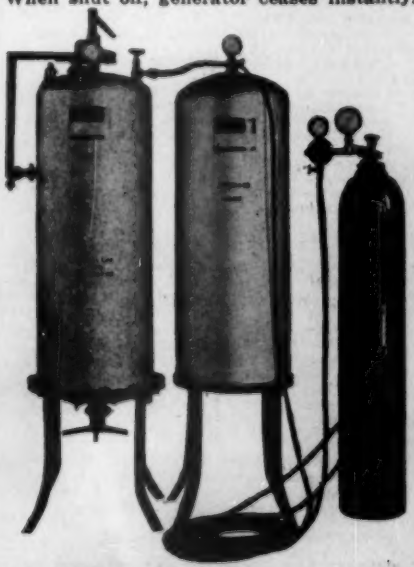

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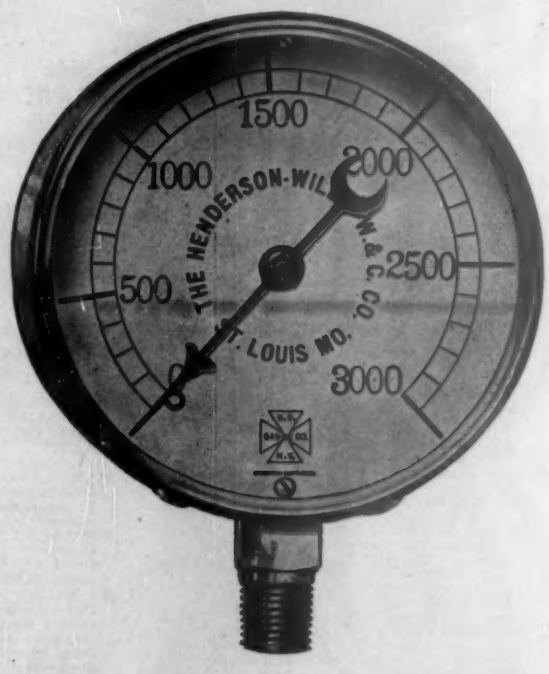

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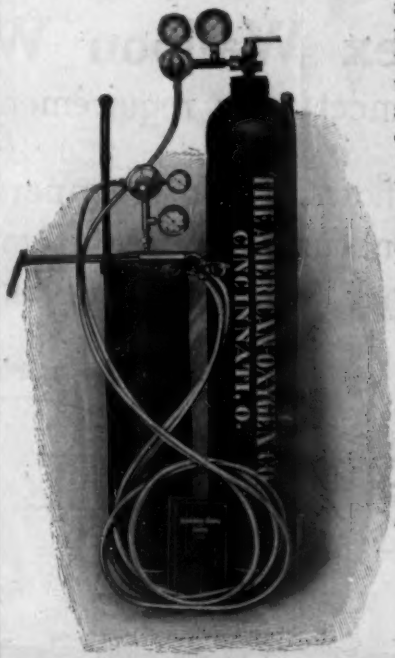

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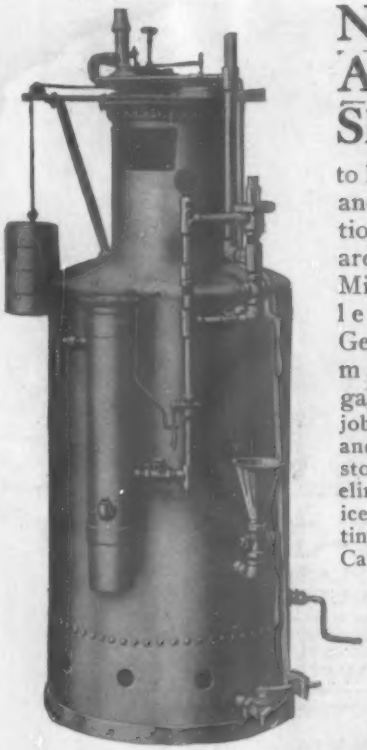

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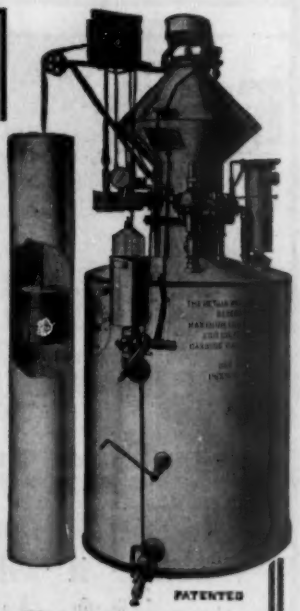

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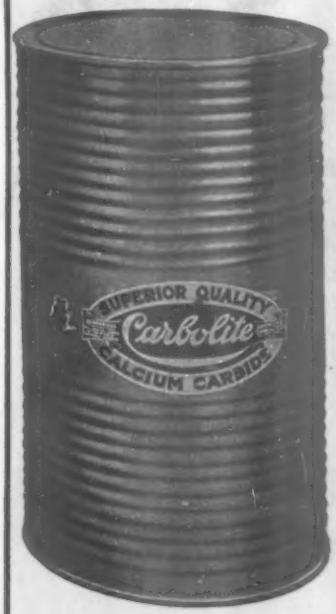

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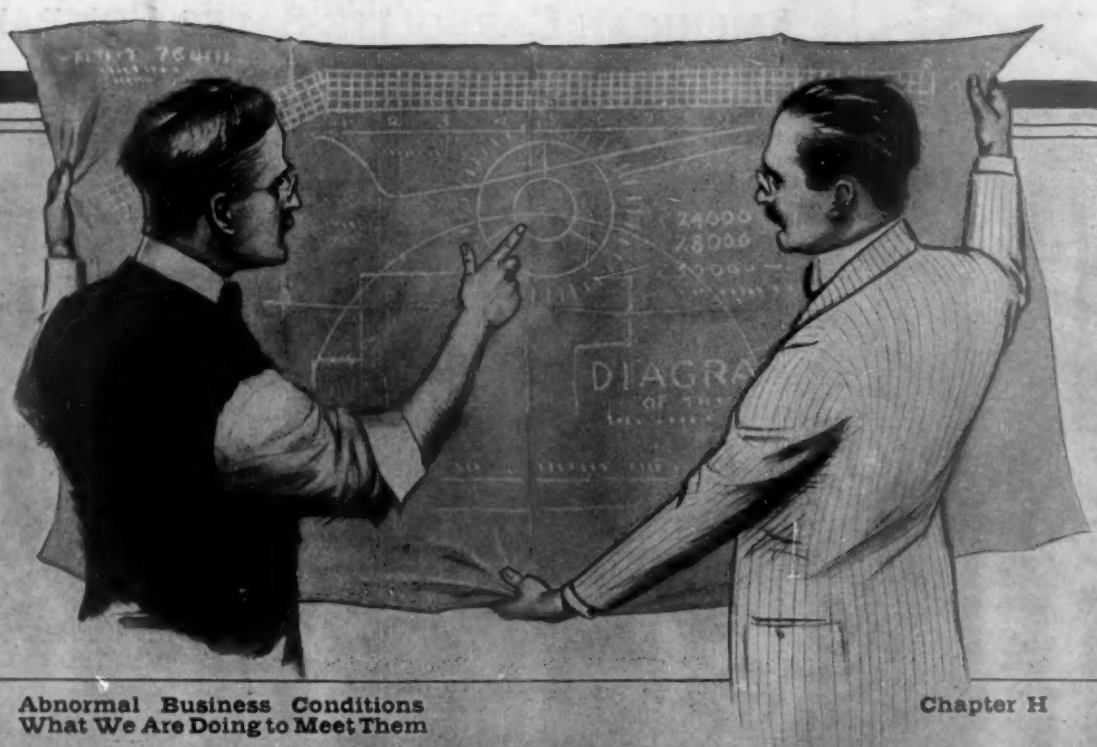

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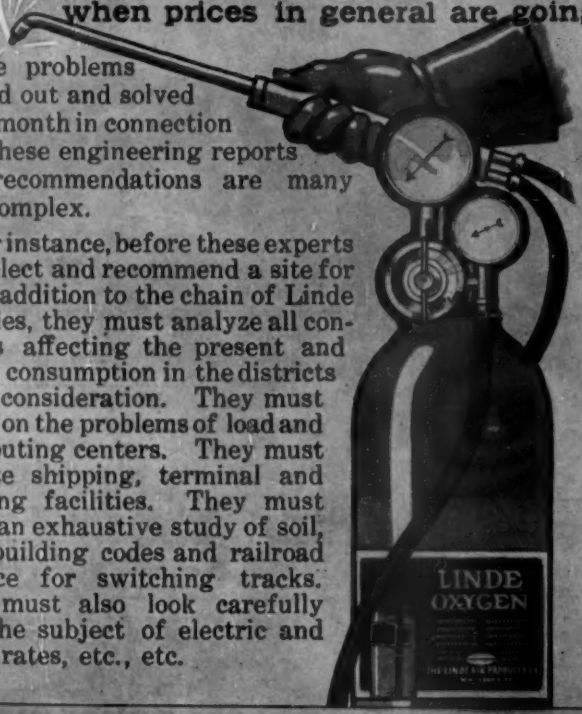
Our engineers and experts now solve most of the problems affecting the price of oxygen. Their exhaustive reports and recommendations cover practically all the factors of quality, cost and distribution.

To this work of these engineers can be credited the economies and savings which have enabled us to reduce the price of Linde Oxygen during a period when prices in general are going the other way.



The problems worked out and solved every month in connection with these engineering reports and recommendations are many and complex.

For instance, before these experts can select and recommend a site for a new addition to the chain of Linde factories, they must analyze all conditions affecting the present and future consumption in the districts under consideration. They must report on the problems of load and distributing centers. They must analyze shipping, terminal and trucking facilities. They must make an exhaustive study of soil, local building codes and railroad practice for switching tracks. They must also look carefully into the subject of electric and water rates, etc., etc.

The engineers' reports incidental to the location and construction of the twelve new units which are being added to the chain of Linde factories to meet abnormal conditions of the past year, are generally classed among the most complete and scientific investigations of factory-location problems ever made in the cities affected.

It must be obvious to the oxygen user that work of this big engineering staff is not confined to the economies of plants and manufacture, but must of necessity be extended to cover matters affecting every phase of the welding and metal cutting.

Chapter "I," the next of this series, will report interesting facts concerning the co-operation of Linde engineering service in developments of great importance in the technique of steel manufacture.

The Linde Air Products Co.
42nd St. Bldg., New York City, N. Y.
"Largest Producers of Oxygen in the World"

OXY-ACETYLENE WELDING *of* LOCOMOTIVE FRAMES

A Practical Discussion of a Class of Work Which Many Think Impracticable

By B. Kopferschmidt

THERE are many railroad men in the country who would like to know whether oxy-acetylene welding on locomotive frames is really practical.

In the writer's opinion the answer is yes. It is necessary, however, that the welds should be properly prepared, a thorough knowledge of the expansion and contraction be had and the proper apparatus should be used with a good welding rod.

The gas welding operation of frames was criticized by some people as being too hot and tiresome; this can be eliminated by employing two or three welders on the job.

It is true, however, that in some shops oxy-acetylene frame welding is unsuccessful.

I have had occasion to examine some unsuccessful welds and as to the outer appearance the weld showed a fine finish, or as the welder calls it, a smooth surface. But in applying the acid test I found that the welder did not consider the oxidation, also the properties of the metal produced, or internal strains. He had it welded thoroughly, and the weld looked good, that was all he cared for, and when failure occurred his employers blamed the method instead the worker.

On the other hand, it does not require a great effort or specialist in welding a locomotive frame. All that is necessary, in addition to the proper welding, is to exercise good judgment in taking care of the expansion and contraction. Thus quality and strength being satisfied, economy of the process is the next important factor. Oil welds is the next competitor to be considered in view of economy. But the chief difficulty of oil welds consists in the exact appreciation, at a glance, of the welding temperature by the color of the metal. In many cases the operator is deceived and the weld may be repeated; thus the unsuccessful welds offsets the economy of oil welds.

However, there are cases where oxy-acetylene welding of frames, even when well applied, may fail occasionally. This may be due to the crystallization of the metal, or where it is impossible to avoid the effects of expansion, considering that the frame is tight on the locomotive.

There may be other causes, where a definite answer would be difficult, chiefly due to the progress in the device and new ideas, so that what we might say today may become untrue tomorrow. However, the experiments of the writer in oxy-acetylene frame welding was a 95 per cent success.

The writer gives below a few operations of oxy-acetylene frame welding.

Fig. 1 shows a frame broken at A and B. In performing the weld at A it is necessary to bevel the broken edges to a 60-degree angle on both sides of the frame. Then with the aid of a jack between both jaws, the edges are opened for expansion about $\frac{1}{8}$ inch. The beveling is best done with the oxy-acetylene cutting blowpipe, and then finished with a pneumatic hammer and chisel, thus leaving the edges bright. A small brick furnace is then built around the beveled edges and with the aid of an oil burner or illuminating gas burner, the frame is preheated to a cherry red. At this point, considering that two plowpipes with the proper welding heads are available, also with the proper welding rods on hand, the few bricks are removed and two welders may start the welding on both sides of the frame. A third welder should be on hand to distribute the welding rods to both welders, to cool the blowpipes when necessary, and to relieve the two men occasionally. Thus in three hours the weld is completed. One operator may weld continuously for one or two hours without getting tired or overheated. A good welder must be also conscientious, and during the entire welding operation he must remember that oxy-acetylene welding consists in making the metals pass from the solid state to the liquid state and, in the new solidification, their intimate union. To avoid oxidation one may use and maintain during the entire welding operation a neutral flame, powerful enough, yet not too rigid as to sweep the molten metal. In this case the oxygen pressure should be as low as possible.

The size of the welding rod should be $\frac{1}{8}$ inch or $\frac{3}{16}$ inch, specially made for frame welding. These rods can be purchased of several reliable manufacturers. A good welding rod will counter-balance, to a certain extent, the loss in mechanical properties due notably to oxidation.

After the welding is completed, to avoid crystallization, one may replace the fire brick furnace around the welded portion, and its immediate neighborhood, and with the preheating burner the weld is annealed and the metal brought to a bright cherry red. At this point the welded portion is hammered all around by two operators and then left to cool for an hour. Then the jack is slowly released to the proper size between the jaws and left there until the weld is entirely cool.

In performing the weld at B (Fig. 1), size of frame four inches, it is necessary to cut off with the oxy-acetylene blowpipe two inches as per sketch. Then the welder builds on enough metal on the vertical jaw, so as to make up one-half of the bevel. Then the other edge is beveled and both edges brightened with a pneumatic hammer and chisel. In this case no jack is used for expansion, but the upper part of the frame has to be preheated at the same time with the lower broken part, until cherry red. At this point both furnaces are removed and the upper part covered with sheet asbestos, so the heat should not affect the operators, and with three welders on the job the same welding methods are employed as in the previous operations. When the welding is completed, the upper and lower parts of the frame are annealed to a bright cherry red at the same time. The lower part is then hammered and the job is completed.

Fig. 2 letter A. The same methods are to be followed as in Fig. 1, letter A, but to obtain expansion the preheating

method should be employed as mentioned in Fig. 1, letter B.

Fig. 2, letter B. The fracture at this point runs to a forty-five degree angle and should be beveled in the same shape. The ⅛ expansion is obtained by a jack placed between both vertical jaws. The same welding, annealing and hammering methods should be employed as in Fig. 1, letter A.

Fig. 3, letter A. Same beveling methods should be followed as in the previous operations, but no jack or preheating is to be employed to obtain expansion. Instead a binder should be bolted on between the next jaws, (see sketch). The welding annealing and hammering operations are the same.

Fig. 3, letter B. The proper expansion is obtained by placing a jack between both horizontal frames and the welding operation is performed the same as in Fig. 1, letter A.

Fig. 4. The proper expansion is obtained by placing a jack between both vertical jaws, the same methods to be followed as in Fig. 1, letter A.

Fig. 5. The first weld should be made at A. Both binders are bolted on as shown in sketch, and the welding operation may be performed successfully without obtaining the usual expansion. After this weld is cooled, the binders are removed and before attempting the B weld a jack is placed between both vertical jaws, to obtain the proper expansion. The other operations are to be followed the same as in Fig. 1 letter A.

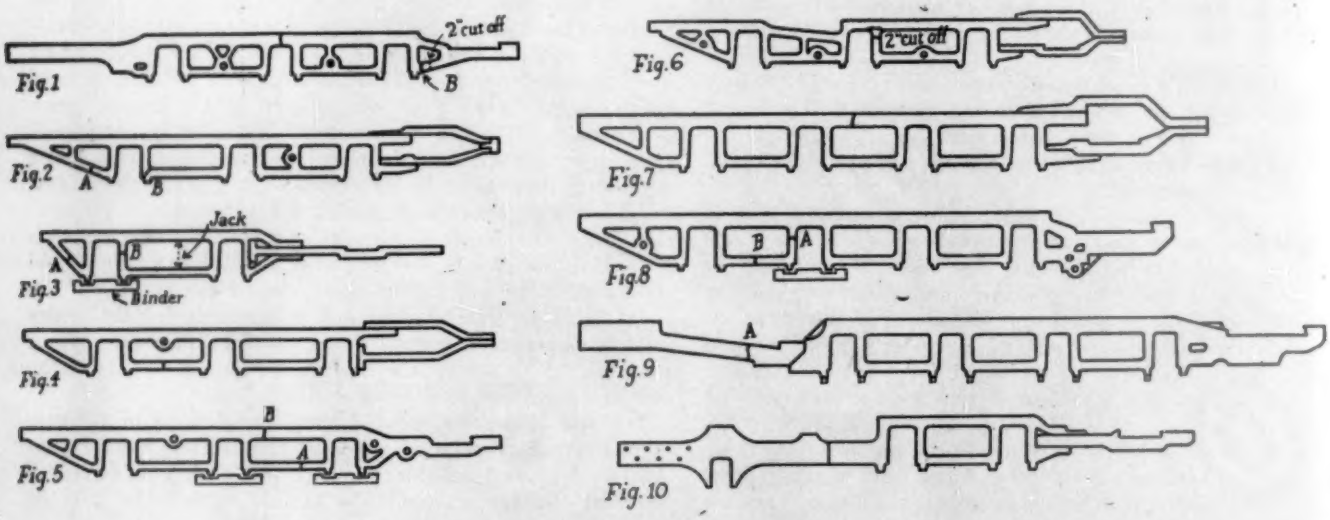


Fig. 6. Two inches should be cut off from the vertical jaw and new metal is built on and beveled the same as in Fig. 1, letter B. To obtain the proper expansion a jack is placed in a vertical position between the upper and lower frame parts. About an hour after the welding is completed the jack is released until the proper size is obtained.

Fig. 7. The same operation should be followed as in Fig. 4.

Fig. 8. The first weld should be made at A. A binder is bolted on, as per sketch, and no expansion is necessary for this weld. Otherwise the same methods are to be followed as in Fig. 3, letter A. Fig. 8, letter B, is then welded the same as in Fig. 5, letter B.

Fig. 9. On this frame, it is necessary to build on about 1½ inches of new metal on the ends of seven jaws. For this operation no preheating is necessary. With the operator standing in the pit, he builds on enough metal on the rear end, and follows the same way, until the whole square is completed. However, at each 1½ square inch portion, the weld should be hammered while hot to its proper size, so as to save machining or chipping.

Fig. 9, letter A. In order to retain the end of the frame straight, it is necessary to have a suitable bracket bolted on the inside of both frames. Although the frame is 2 inches thick, the bevel should be made on both sides and welded by two operators, one on each side. No expansion is necessary for this weld.

Fig. 10 shows seven 1½-inch holes which are to be welded on a 2½-inch thick frame. It is necessary to insert in each hole a blind washer, about ½ inch thick; same diameter. Then the hole is welded up by two operators, one on each side of the frame. This method of welding up holes is not only efficient and economical, but it leaves a soft weld, easy to drill.

FLEXIBLE METAL HOSE AND TUBING.

Engineering plants, factories and all concerns engaged in technical and mechanical work often require the use of a reliable hose which combines the three essentials of flexibility, durability and efficiency. The ordinary rubber hose on which the trades were formerly dependent was liable to kink, collapse or blow out. The most reliable form of hose now on the market is the flexible metal hose and tubing. This is the cheapest in the long run and can be used for the conveyance of steam, oil, water, air and gasoline and also for suction purposes. Steam does not vulcanize it or make it hard and brittle, oil does not affect it or dissolve it. Used for suction purposes, the flexible metal hose is not affected by rubbing or friction on the outside and cannot collapse.

The Atlantic Metal Hose Co., 1777 Broadway, New York City, is manufacturing a high grade line of flexible metal hose and tubing in galvanized steel, bronze and brass, etc., in diameters ranging from three-sixteenths of an inch to six inches as standard stock. The company is issuing attractive literature describing every type of its products and those interested can obtain illustrated data and prices upon application.

The fourth annual meeting of the Compressed Gas Manufacturers' Association will be held at the offices of the Association, 120 Broadway, New York City, on Monday, January 15th, 1917, at 2 o'clock p. m. Meeting will as usual be followed by the Association's annual dinner at the Manhattan Club, 26th Street and Madison Avenue, New York City.

Officers for the year 1916 are as follows: Dr. Hugo Lieber, 120 Broadway, New York, President; Mr. A. R. Brunker, 3100 So. Kedzie Avenue, Chicago, Ill., First Vice-President; Mr. A. Cressy Morrison, 42nd Street Building, New York City, Second Vice-President; Mr. Otto S. King, 218 East 42nd Street, New York City, Secretary and Treasurer.

REMINISCENCES *of a* WELDER

Each With a Moral.—II. The Rear Housing on That Darracq Car

TEN years ago the process of oxy-acetylene welding was introduced into this country. It was two years after that date—in 1908—that I climbed on the band wagon. So as time is reckoned it isn't very long, hardly long enough to justify the title of these little incidents, for the word "reminiscent" somehow impresses one as looking backward scores of years; yet none of these reminiscences are over eight years old.

But when the remarkable progress of oxy-acetylene welding and cutting in these few years is considered—the thousands of equipments in use, the big number of gas plants, the ease with which jobs are done now which were considered impossible a few years ago—in other words when we who were in the industry then and now compare these things, the years seem to lengthen.

I often wonder if it is because of this that welders are prone to add a few years to their actual experience. I've talked with men who nonchalantly stated that they learned oxy-acetylene welding in the Navy Yards in 1905—some years before any Navy Yard installed an equipment. Others casually announce that they worked for such or such a company some years before that particular such or such a company existed. Most of us have heard of the bachelor who, being told that statistics proved that married men lived longer than single ones, replied that they didn't live longer; it just seemed longer. Perhaps the welding industry affects us the same way, for surely it does seem longer than eight years ago that some of us knew so little about the wonderful qualities of this hottest of all flames.

I believe it was in 1909 that I had a monopoly on the oxy-acetylene welding business in a city of over 600,000 people. Another shop had started but had not survived. Their average on cylinders was about one in ten. Ours was a little better on that particular class of work but was nothing to boast about; but we were getting some fine practice—on the customer's job. It wasn't by any means an even bet that the owner of an aluminum case would get his case back in usable shape, once he entered our shop door; the odds were all against him. But automobile parts were terrifically high in price and the owner simply had to take his chances with the then poor and uncertain quality of welding work.

The oxy-acetylene industry has never extended to the automobile owner the proper credit for his share in the development of the industry. Think of the hundreds and perhaps thousands of welders who have been trained to repair work at the expense of a ruined auto casting or part. But the owner submitted because there was nothing else he could do. On the one hand, he was at the mercy of the manufacturer; on the other, the welding shop with its willingness to try and if successful, charge a salvage price—and in those days there were quite a few "successful" jobs from the welder's standpoint which did not measure up to the same standard from the owner's.

Came a morning when into the shop was toted one of the biggest rear housings, for a pleasure car, I have ever seen. It was from a Darracq taxicab and like all auto work was wanted in a hurry. It must be ready to put back to take advantage of the evening's trade. The car could be laid up in the daytime with little or no loss and later events proved this a fortunate thing for the owner. Could we weld it that day and how much would it cost? Sure we'd weld it that day. The cost was not so quickly decided upon, however, for those were the days when the successful job had to make up for the many unsuccessful ones. Finally, a price of $30.00 was agreed upon to weld a break about 14 to 16 inches long and about ⅜ inch thick.

This was our first rear housing job and we took it for granted that it was a steel casting. We were well aware that a rear housing must stand considerable strain and therefore cast iron should not be used. Which was sufficient evidence to us, in our blissful ignorant state, that if it wasn't cast iron it must be steel.

As the housing was completely broken the edges were ground down on a stationary grinder and after lining it up on a fire brick top table, we put the preheating flames on it to save gas by getting the line of welding to a red heat.

A mild steel rod was to be used for the filler rod and as the welding torch flame played on the break, the first surprise came. The metal melted queerly. It didn't have the clear, clean appearance of steel but seemed to be mottled and to melt sluggishly. As the rod was added, it didn't mix properly with the material. Holes appeared which could not be filled up. After a couple of inches of this kind of welding, a conference was decided upon. What the dickens was this metal anyway? Somebody suggested it was malleable iron and having read sometime, somewhere, that malleable iron was cast iron which had been annealed, the mild steel rod was discarded and a cast iron one substituted and again the weld was begun. This was something like it, the metal flowed better and to make a god job, we piled up that filler rod until the welded section was fully an inch thick. Then we played the preheating torch on it until it was a bright red, allowed it to cool slowly (this being our idea of proper annealing) and late that afternoon, the owner took the housing and we took his $30.00.

The next day was uneventful but the following morning back came the housing, broken directly through the weld. Followed the unusual autopsy. Cause of the break? Lack of alignment. So, laboriously that added iron was ground down. Did you ever try to grind malleable which has been melted? Lay in a stock of wheels before attempting it for it must be nearly as hard as a diamond.

This time we were careful in setting the job up and to make an extra good weld, perhaps it was made 1½ inches thick, but we used cast iron for the filler rod just the same as before and just the same as before the housing came back a couple of mornings later broken in the same place. Again the metal was ground down and again the job set up ready for welding. But this time we had to devise something new. Eureka! we had it. Cast iron was all right to fill the holes but it required steel for strength, so alternating with mild steel and cast iron we made the weld. Again we "annealed" it and for the third time the owner took it away.

Just how long he stayed away, I cannot at this time remember, but well do I remember how mad he was when

he brought that housing back for the fourth time. And this was to be the last time. If it broke again, he wanted his money. We hardly blamed him, yet we needed him for two reasons—the fine experience we were getting and the $30.00.

At the suggestion of the shop superintendent, who had done considerable brazing, but who never could learn to operate the oxy-acetylene torch, we decided to give brazing a chance. Under his supervision three wrought iron straps were laid crosswise of the break and tacked on each end with the welding flame. Then a fire brick furnace was built and the preheating torches used to get the metal to a bright red heat. With flux and spelter running through the break which had been welded and around the straps, the job was finally completed and this time it didn't come back. We had learned something, but learned it at the cost of considerable money and lots of work. From using preheating flames to the oxy-acetylene flame was but a step and at the same time a brass rod was used instead of spelter. Later, brass was discarded and bronze employed.

We had learned what every welder should know and most of them do. How it is in the form of a

Moral: Malleable iron cannot be welded but it can be brazed.

Next Month—Curfew Shall Not Ring Tonight.

ELECTRIC ARC WELDED HIGH PRESSURE CYLINDERS.

By George Hills.*

Prior to the European war nearly all of the seamless steel cylinders as used conjunctively with Diesel Engines, were imported from Germany; great inconvenience therefore was experienced by manufacturers of Diesel Engines through lack or air flasks or cylinders, in this country. Attempts were made to produce a similar article by American manufacturers, but with small success, only one concern being able to produce the larger ones, these being of 40,000 cubic inches ca-

Arc Welded High Pressure Cylinder.

pacity. They were greatly handicaped, however, by reason of the great demand for their other products, and could scarcely make deliveries under six or eight months.

The author conceived the idea of taking very heavy lap welded pipe and inserting heavy forgings in each end, and welding same into position electrically. The first ten were made for a large Diesel Engine manufacturer in Philadelphia. These were 10 in. inside diameter and 10 ft. long. The success attending these prompted the author to go strongly after that class of business; later, fifteen were made for a large Milwaukee, Wis., concern. Five of these were 10 in diameter, 5 ft. long, and ten were 18 in. diameter and 11 ft. 6 in. long, both sizes shown in cuts No. 1 and No. 2. Steel forgings 2 in. thick were welded in the ends of the small cylinders and forgings 3 in. thick into the ends of the larger ones. These cylinders were tested under pressure of 3,000 lb. per sq. in., in conformity with I. C. C. Specification No. 3.

The forgings were welded into the pipe by beveling the edges as shown in Fig. 2, and welded from the bottoms upwards for a depth of about 1 in., using a metallic electrode approximately 170 amperes, 65 volts, and the balance was

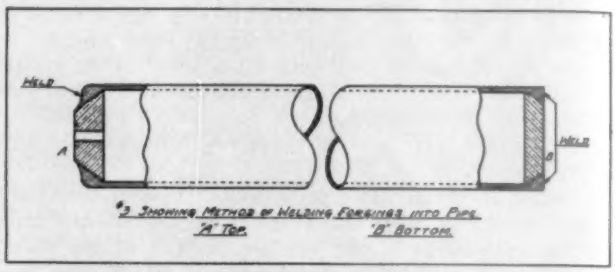


Fig. 2. Showing Method of Welding Forgings into Pipe. "A" Top. "B" Bottom.

Fig. 2. Showing Beveling of Pipe.

welded, using a carbon electrode and a rod of Armco iron as a filler; 400 to 450 amperes at 70 volts were used in this latter method.

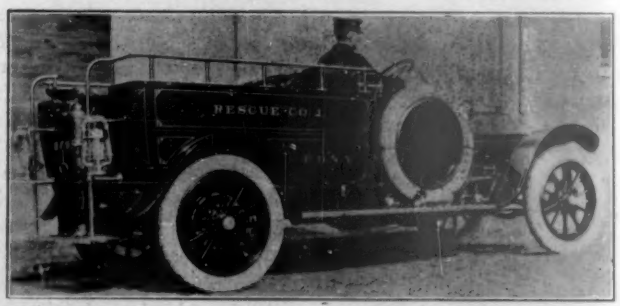
Such flasks or cylinders are of excellent quality, and a splendid field is open to those who will take advantage of the opportunity.

The author will cheerfully answer any questions on the subject, and render any assistance possible to those interested.

*The American Rolling Mill Company.

RESCUE WORK IN N. Y. FIRE DEPT.

A New York newspaper recently gave the impression, in discussing an elevator accident, that the City Fire Department was not fully equipped with cutting apparatus. Our attention is called to the fact that the department is fully equipped with rescue trucks, each of which carries a special



New York Fire Department Rescue Truck Equipped With Cutting Torch.

K-G Oxy-Blaugas cutting outfit. There is one of these rescue trucks in every borough in the city. The equipment mentioned may be seen in the illustration. It is located on the rear of the truck, with special size cylinders and clamp with handles, to enable its being carried easily by one or two men.

CARBO-HYDROGEN CATALOGUE

The Carbo-Hydrogen Company of America, with offices at Pittsburgh, Pa., has just issued an attractive new catalogue descriptive of carbo-hydrogen and equipment for welding, cutting and lead burning.

It briefly describes the merits of the gas for the various uses and illustrates and describes cutting and welding torches, lead burning torches for air and carbo-hydrogen, regulators, etc.

THERMIT WELDING *for* RAILROADS

Why N. C. & St. L. Ry. Uses Thermit for a Great Variety of Repairs

By Albert L. Seals

THE accompanying illustrations are of Thermit repairs, made at the Nashville shops of the N., C. & St. Louis Ry., during the month of July this year. This is not the entire month's work, as there were three other repairs made of which we did not obtain photographs. Each of these, however, was of the same character as the one shown by Fig. 1. I think this record of a month's work will be of interest to your readers.

Fig. 1 illustrates a weld on the left front pedestal jaw of Engine 286, a Baldwin balanced compound locomotive in passenger service. The part shown below the line was broken entirely off and a new part was added on of Thermit. An inspection of the illustration will show the way by which this was accomplished. The part to be added was formed by a wax pattern, which was made to extend onto the main part of the frame for a distance of two inches and an allowance of three-eights of an inch was made on all sides for shrinkage and stock to properly finish to the sizes required. I note, from articles from other welders, that at this point on an engine frame, where the lip or toe is not broken off, and only a fracture occurs, they have just drilled an opening as far as the fracture goes and then repaired this opening with "Thermit." I admit that this method is somewhat more speedy in execution, as it does away with some chipping, but I am convinced by observation of repairs made in this way as compared with the way shown in the illustration, that the latter method gives the best repair.

Figs. 2 and 3 show two views of a cast-steel guide yoke on the left side of Engine 537, a Pacific type passenger engine. In this case only a fracture extending about half across the face was found, but the yoke was cut in two at the fracture. An opening 1 in. wide was made to passenger engine. In this case only a fracture extending about half across the face was found, but the yoke was cut in two at the fracture. An opening 1 in. wide was made to allow for the flow of the Thermit steel. The two parts were then held in position to be welded by means of bolts passing through the pieces of pipe, to hold them the right distance

Fig. 1. Pedestal Jaw of Locomotive. Completed Weld Chipped Flush.

Fig. 2. Guide Yoke of Locomotive.

apart, after which the weld was made in the usual way. The bolts and pieces of pipe are shown plainly in Fig. 2, while Fig. 3 shows the yoke as applied on the engine. It should be said that the pipe used in this instance was 1½ in. and was cut off in a lathe to insure a square bearing, after the risers were cut off the yoke was placed in position on the engine and the guides were alined, using the same bolts and holes that were in the guides when the engine came into shop; no heating being necessary to take the twist out of the yoke. I have welded four yokes of this kind and have used this same method of holding the parts in place, in each instance it was only necessary to apply the yoke the same as though no repairs had been made on them.

Fig. 4 shows a frame weld on the right side of this same Engine 537, by inspecting No. 3 a good idea will be had of

Fig. 3. Guide Yoke of Locomotive.

the construction of the frame at this point; it also shows the part of frame that was cut away to allow room for Thermit collar.

Fig. 5 shows left main driving wheel center for Engine 386, a consolidated type freight engine of 38,000 lb. tractive effort. This repair was an unusual one for me as I had never been called on to repair a wheel center in all my Thermit welding experience. I decided that some allowance should be made, if possible, for contraction of the weld after pouring. This was secured by opening the rim of the wheel center between the same spokes that contained the fracture. A slot 1⅛ in. wide was cut at the point of fracture, which is shown by line in Fig. 5, then a slot ⅝ in. wide was cut in rim at the point shown by the arrow; after these slots were cut, the fracture was cleaned off by chipping away the scale that was left when the center was cast, it being a cast-steel center. Considerable scale is always encountered in steel castings and one can't be too sure about about getting all of this out of the way; after cutting the slot in rim, referred to above, there were then two slots in rim, one of these was 1 in. wide and the other ⅝ in. When all of this work had been done the center was placed in position to be welded with the outside of the center down, on account of the projection on that side that would admit of easier heating and pouring. Having securely blocked the center so that the welding process could

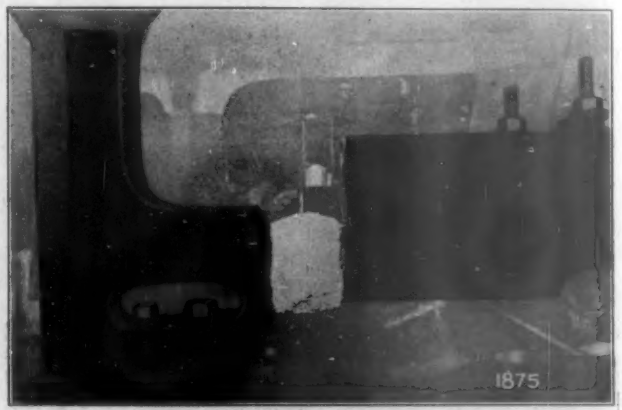


Fig. 4. Frame Weld.

be carried out, a wedge was driven into the slot in the center of the wheel and that slot opened to 1¼ in., or an expansion of ⅛ in. at point of weld; this opened the ⅝ in. slot to 1 in., the other slot in rim being 1 in.; two keys were then procured that were 1 in. thick and were driven into the slots in the rim; this held the slot in center open ⅛ in., or 1¼ in.

Fig. 5. Driving Wheel Center.

The repair was then continued the same as any other Thermit weld. In heating for this weld, which required 5½ hours, the heat expanded the wheel center so that the key that was driven into the ⅝ in. slot fell out; this has caused me to debate with myself whether or not it was necessary to expand a weld of this character or not before the wax pattern is applied. I rather think that this expanding should be done beforehand, as there is a certainty of exactly how much Thermit is required for the job. This would require 100 lb. of Thermit. The nature of this repair required that the Thermit collar be machined off on three sides for rod clear-

ance on the outside, hub liners on the inside and axle fit. In boring for the axle the boring mill man said that he did not see how it could be held as it was just "stuck together." The man that fit the axle promised that he would "bust it," but 85 tons hydraulic pressure, to press the axle home, failed to "bust" any part of it, or even open the slot that was made in the rim. I think that this weld convinced these two men. This engine has just left Nashville after a thorough overhauling with this wheel under it, so I have no means of telling yet as to its service, but will keep an eye on it.

Fig. 6 shows this wheel center on the axle ready for tire.

Fig. 7 shows weld on a link frame, or link carrier on the left side of Engine 605. This fracture was caused by the engine stripping itself and a rod-struck carrier breaking the

Fig. 6. Driving Wheel Center on Axle Ready for Tire.

latter. Engine 605 is a Mikado type freight engine, 50,000 lb. tractive power.

The photographer failed to obtain as good a view of this as I would have liked, as he failed to show all of the frame so that its construction could be seen. It is of such construction that there was left a short piece to be welded onto the other part; this small part was held in place by means of a plate of boiler iron with holes in it that just matched the holes before the break occurred. Clearance for the flow of the Thermit metal was cut off the short piece, after which the parts were bolted together and the weld made.

Fig. 8 shows a Thermit repair on a 5 cu. yd. capacity steam shovel dipper knee. This is about one of the quickest repairs that I've ever made. Was called for the job about 6 p. m., but failed to get the parts to be welded until 8 o'clock of the same night, then clearance had to be cut and the parts lined up, cleaned off, etc. All this was done in record time and the knee was placed on board a train for shipment the next morning at 7 o'clock. Taking into consideration the size of the job and weights of the parts to be handled, this was quick time. This knee altogether weighs about 500 lb. and its shape makes it very difficult to hold in any position. This piece was replaced on the dipper and the shovel has been in continuous service since with no trouble from that source at all. That weld was made in March of this year.

There is a difference in making a repair of this kind as compared with repairs as shown by Figs. 1 and 2, 3 and 4, or 5 and 6, these being heavier, while the ones shown by 7 and 8 are lighter or smaller parts. The difference appears in the preheating of the parts, lining up and holding in place. It is much easier to hold engine frames in line and in place for repairs than it is to hold either the guide yoke, link frame or dipper knee shown in the illustrations. First, because the parts are heavier and then there is always some other part of

Fig. 7. Weld on Link Frame, or Link Carrier.

Fig. 8. Weld on Steam Shovel Dipper Knee.

the engine, to which connections can be made, that will give the desired stability to assure one that the parts will stay where placed until the repair can be completed. Then, in preheating, the larger the parts are, the better the heat is for the reception of the liquid Thermit. I believe that it is just as essential that the molding material should be brought up to the proper heat as it is that the parts to be welded should be at the proper heat. We know, for a fact, that molding material to pack properly must have a certain amount of water added to it, first, because it will not pack dry, second, because it will not stand the heating process while in a dry state. To place the molding materials in the mold box dry, would allow the air blast used in preheating to cut the material out, thus making a weld that would have no shape to it, so we must of necessity add water to the molding material. Thus it follows that the longer we are in obtaining the proper heat on the parts to be welded, the dryer becomes the molding material, which lessens the liability of pipes in the weld. Take, for example, the link frame shown in Fig. 7; this frame at point of fracture is only about ½ in. in thickness. With

the preheater that I use this can be made hot enough for a weld in about 40 to 50 minutes, but in this particular case the preheater was used for one hour and fifty minutes; that the end justified the means is attested by the fact that there is not a flaw of any sort in this repair. I do not let the preheater run at full blast in a repair of this kind, but cut the flame down to a point where it will just about keep the parts at one heat until I feel sure that the mold box is sufficiently dry.

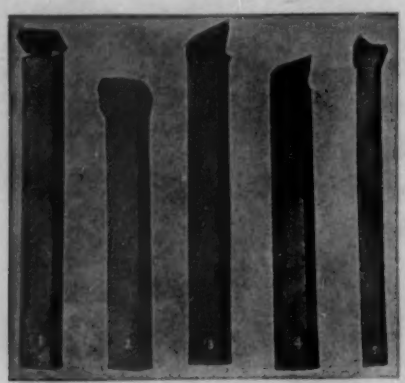
I have purposely sent this collection of photos to show the range of repairs to which Thermit is used at the N., C. & St. Louis Railroad Shops.

That they regard Thermit favorably is shown by the many and varied uses to which they put it. An engine frame is seldom removed from engine for repairs except when it is necessary.

Responding to the toast proposed by Mr. Bell, will say that I heartily concur in all the sentiments proposed by him. Could his wishes be brought about, then this would be a better world. Let each of us promise that we will do what is in our power, small though it may be, to bring this to pass.

CUTTING TOOLS MADE BY ELECTRIC WELDING.

At the present time the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is using a number of welded cutting tools in its planing machines and lathes. They were made by welding high-speed steel tips to shanks of machinery steel by means of the arc welding process. This process has been found cheaper than either oxy-acetylene welding or forging and enables wornout high-speed tools to be cut to tips of the proper size, thus effecting a considerable saving. In the accompanying illustration the



Successive Stages in the Welding of High-Speed Steel Tips to Machinery Steel Shanks with an Electric Arc Machine from the Preliminary "Tacking" of the Tip to the Shank to a Finished Tool Which Broke Outside of the Weld While Being Subjected to a Hammering Test.

successive stages in the production of the tools are presented from left to right.

The high-speed tip is first tacked to the machinery steel shank as shown at 1. After applying borax as a flux, the welding is begun and when this is completed the tool is laid in mica dust to cool gradually. At this stage of the process the tool has assumed the shape illustrated at 2. The tool is then given an initial grinding as shown at 3, after which it is tempered and the grinding operation completed. This makes the tool ready for use and one in this condition is illustrated at 4. The tool at the extreme right marked 5 is one which was hammered to test the strength of the weld, and, as will be noticed, while it broke the fracture was above the weld.

The machinery steel shank used may be of either hot or cold-rolled or carbon steel and of any desired length, while the steel tip should be short. The metal of the shank, which is relied upon to reinforce the tip, is built out and around the latter. In this way, it is explained, a larger radiating surface is provided, as well as a conducting path of greater area back to the butt of the tool, which keeps down the temperature at the cutting end. An ordinary Westinghouse electric arc welding equipment, such as is employed for the welding or repair of castings, is used, a Norway iron electrode 5/32 in. in diameter being utilized. To secure the best results a current of approximately 100 amp. is recommended and a voltage of from 60 to 70 volts. The work, it is stated, should not be hurried, although a good operator should be able to weld from 25 to 30 tools having a cross-section of 1½ sq. in. in a 9½-hr. day.

THE LARGEST BRAZING JOB IN THE WORLD.

By William Herron.*

Brazing, one of the oldest of arts and closely related with welding, and of which one hears so little about during these days when most all metals are autogeneously welded, has played a most important part in the construction of an absolutely watertight conveyor for New York City's new water supply system.

If one were to drop down 225 ft. below the surface of Broadway at 24th Street he would witness this wonderful brazing accomplishment. The Catskill-New York aqueduct which will supply the great metropolis with pure mountain spring water is being lined with copper to prevent the water from escaping through the concrete walls of the tunnel.

Fig. 2. Brazers Lining Water Main with Copper.

To carry out this work, the like of which has never been attempted heretofore, involved a great deal of study of conditions, and not until extensive experiments with those intangible laws of contraction and expansion were carried out was the work ready to proceed with proper results. In order to obtain a comprehensive idea of the work one must be mindful of the size of the tube being lined and brazed. The diameter of the tunnel being 12 ft. and the circumference 37.5 ft. The copper lining is composed of heavy sheet copper of 13 gauge and in sheets 4.5x12 ft., the sheets having three corrugations to allow for expansion and contraction. The sheets are fastened to the wall of the tunnel by specially devised anchor bolts, each sheet lapping the other 1 inch.

The most difficult part of the work has been the brazing of the sheets. Owing to the high heat conductivity of copper, together with it being laid on the concrete wall, it requires a very heavy flame to heat it sufficiently for running the brass. The brass is in No. 6 wire form and of a composition of 63-35. In order to obtain strength to withstand the pressure

*Superintendent in charge.

of the water which will fill the tunnel when lined, the brazing must hold the surface of the laps fully .75 in. and must also be continuous and free from skips and blow holes, due to the volatilization of the zinc from the brass, caused by excessive heating.

The laps are cleaned, all oxide being removed by a portable emery wheel (the use of acid for cleaning being prohibited owing to the fumes resulting). After being cleaned the laps are held tightly together by two clamps, pressed against the seam with pipe jacks. See Fig. 2. Borax is the flux used, both surfaces of the laps being heavily coated.

The brazing is all accomplished by the use of the oxy-acetylene process. A very heavy flame (No. 9 tip) is required to produce sufficient heat to heat the copper and absorb the dampness from the concrete behind. The system which the operators are instructed to follow is one that insures a perfectly homogeneous joint, free from skips and blow holes. The operators are cautioned to work slowly and run the molten brass along 3 inches of the seam before running it between the copper. Plenty of borax permits the brass to run like solder. After the seam is full of brass the welding flame is lowered and the copper heated, which draws the brass .75 in. between the laps. The work progresses inch by inch until a pair of sheets have been brazed together. Care must be taken by the operator to keep the flame moving constantly, as a hole can be very easily burned in the copper, which becomes almost white before the brass runs freely.

It requires, more than one can imagine, skillful manipulation of the torch to bring good results, as the seams are brazed in various positions. For example, those seams on the bottom of the tube run the easiest, but those on the top are much more difficult, as the operators must work overhead with the arms for 45 minutes at a stretch. Still more difficult is it to braze the circular seams. Here the operators must braze vertically and must be skillful enough to build up inch by inch, and run the spelter between the laps the required .75 inch as well as is done on the horizontal seams.

Were the seams to be placed end to end, they would reach from the Battery to the Flatiron Building (about 3 miles).

The copper lining, when brazed, is tested with water, proper frames being constructed to withstand the pressure of the water which is pumped between the concrete and the copper at a pressure of 6 lbs. per sq. in. With the water behind the copper each seam is carefully inspected and all leaks checked and rebrazed. Small leaks are found at the seams where brazing is most difficult, especially on the side walls where the seams are plumb vertical.

The copper lining must be absolutely watertight as the pressure against it will be nearly 300 lbs., when the tunnel is completely filled with water from the mountains.

The engineers and contractors, Lupfer and Remick of Buffalo, N. Y., have established a record for extensive brazing, and are to be commended for the achievement of an unprecedented undertaking. Brazing is seldom contracted for by an engineering concern whose work is mainly tunnels, waterways, bridge building, etc.

We might look for the day when the "man with the torch" will fasten our bridges and weld our sky scrapers, and supplant the noise of the riveting hammer with the quiet, efficient torch.

TIP-WELDED TOOLS

I read an article in the *American Machinist* that told how to braze a piece of high-speed tool steel onto a piece of iron with an electric welding plant. Here is a method that may be employed by the small shop that does not possess an electric outfit:

The tool is made of common wrought iron ½x1½ in., with a ½-in. square piece of high-speed tool steel brazed into the gap cut on the end. The work is done by simply heating the iron and cutting out a gap large enough for the point. The steel is put on the bar of iron, which is laid in the fire with the steel side up.

A slow blast is used, and when the iron and steel are at about the heat required to forge the steel, the compound is put on top of the steel, and when it melts the work is taken out of the fire. As soon as the steel adheres, the tool is tempered under a blast. The compound used is a mixture of fine brass shavings and pulverized borax. There is no special rule for mixing.

Aldrich, Ala. Joe Gilleland.

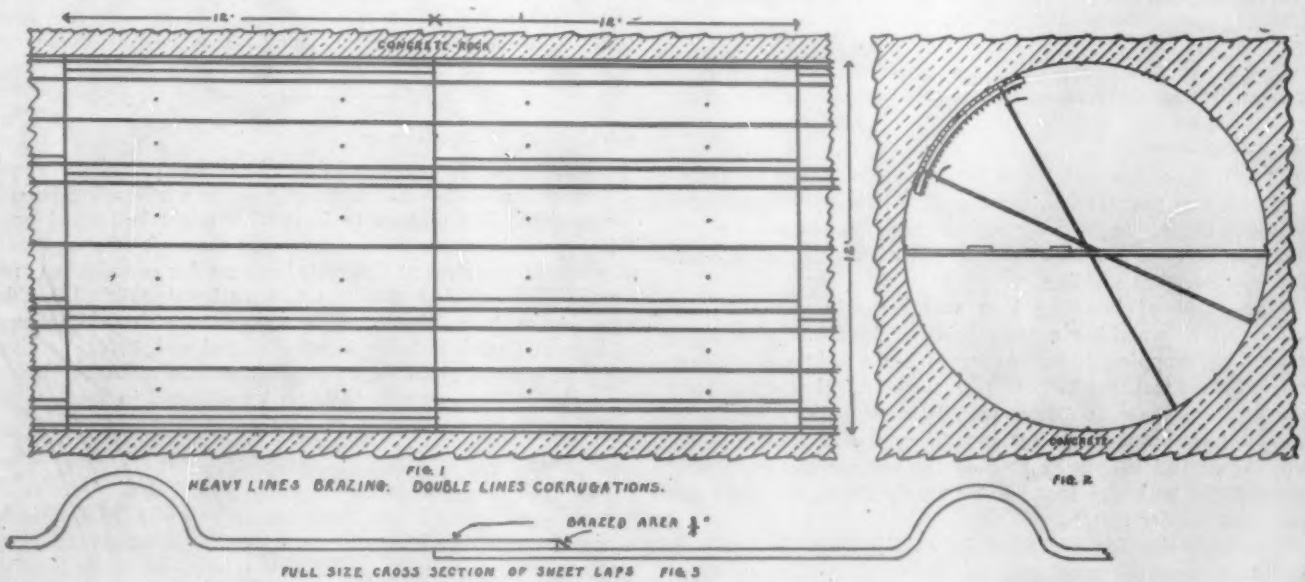


Fig. 1. Cross Section of Water Main Lined with Copper.

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VOLUME 1. DECEMBER, 1916. NUMBER 12.

Knowing How

ONE of the reasons for failure of welds is lack of knowledge of preparation. In a casting,this failure may be because of neglect to properly preheat. In construction work, it may be because previous training has been along lines which did not embrace welding.

The value of knowing how was recently called to our attention in watching a tank being welded and afterwards tested by dropping it on concrete from a height of 20 feet. On the first test, the bottom seam opened. If this had been an ordinary case, welding would have been immediately condemned, but in this instance the man in charge knew the "how" and simply by turning the bottom the other way around, the tank was found to be amply strong to stand this and even harder tests.

The necessity for education in welding lines is not only urgent among the men who do the work, but many times among the engineers who design the article to be welded; for it is absolutely essential in many instances that to insure success, this design be such that it meets the requirements demanded by the welding process.

Mr. Dooley On Advertising

MR. DOOLEY, of humorous fame is credited with saying that the subscribers have a right to object if too much reading matter is found in one issue of any magazine. Mr. Dooley was right—the magazine without live, interesting advertisements would be dull indeed. The advertising pages of the trade paper reflects the progress of the industry. Without them the paper would be dull and uninteresting indeed. The man who skips the ads is usually the fellow who is least informed.

Teach Welding at Universities

THERE are more than one hundred universities and technical schools ih the United States interested in the subject of welding. Some of them know this, some of them merely suspect it, while others are wholly uninformed on the subject. We have taken it upon ourselves to carry on a little educational campaign among the schools. We advocate the extension of the curriculum to include a working knowledge of every system of welding for students of engineering and mechanics. We like suggestions.

Help the Good Welding School

AS WE have often declared in these columns, The Welding Engineer is most heartily in favor of welding schools. We believe there should be better schools and more of them. As good schools increase in number we may expect the welding industry to expand. In the meantime, however, why not consider the case of existing private schools now teaching welding. Several schools of this class are doing very good work and merit the encouragement and co-operation of those who have the welfare of the industry at heart. Manufacturers might do well to investigate this phase of the situation with a view to lending their co-operation in building up such schools.

Business Conditions

AS THE year draws to a close we find the welding industry flooded with new business. Practically every manufacturer of welding equipment and supplies is working to capacity. There is a growing belief among American business men that the end of the war will in no way affect this country's industries inside of five years. Whether this is true or not remains to be seen, but we do believe that before the wave of prosperity recedes those manufacturing plants which are built in 1917 will have paid for themselves. Welding and cutting spells economy, so it would seem that we are going to get them going and coming.

Certificates of Proficiency

LAST month we announced that *The Welding Engineer* would establish what would practically be an examination bureau for welders. We propose to issue what might be termed proficiency certificates, to those members of the craft who may care to present themselves at designated centers for examination and rating. The complete plan was to have been published in this issue, but has been delayed. We are expecting a detailed account of how this work is being handled abroad and, before issuing our plan, wish to profit by the experiences of our brother welders abroad. The plan will doubtless be published in January.

Efficiency.

HOWEVER any of us may view the participants of the great slaughter abroad, one thing stands out with great prominence—the efficiency of the German Empire. We may agree or disagree with her military policy, but we cannot ignore the tremendous progress she has made, and probably continues to make, in her industries. And the fundamental reason for this wonderful efficiency in her industrial establishments is simply CO-OPERATION.

Not the least important of Germany's industrial progress has been in welding and to a large extent this progress has been made possible by teaching. We believe—yes, we know—that this country would be benefited by the general teaching of welding and cutting. Unfortunately, perhaps, our government, unlike Germany, has not reached that point of view where aid may be expected. Individual concerns and some automobile schools are teaching welding and undoubtedly much good will result from some of these isolated cases, but to do the greatest good to the greatest number in the quickest time requires the concentrated effort of the entire industry.

No one man or no one set of men is capable of teaching welding as it should be taught, but co-operation—real co-operation of all interests—makes the scheme feasible and capable of quick execution. We have too much faith in the judgment of the welding men of this country to believe that they cannot get together and work in harmony for this one big object.

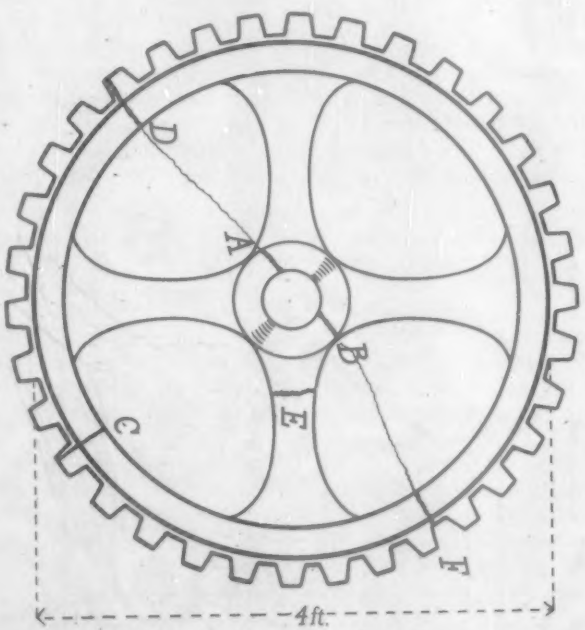
Hints for the Welder

When you finish an interesting piece of work, can you set down on paper the manner in which you went about the job, how you prepared the work and how the job was done? Have you learned some little stunt every welder ought to know? Contributions to this department are paid for. Write it down any old way—I'll polish it up. Make a rough pencil sketch and our draughtsman will fix it up fine. Line drawings are more practical than photographs. Do it today—the men on the firing line are waiting.

L. B. Mackenzie, Editor.

WELDING LARGE GEAR WHEEL.

Editor: Enclosed sketch represents an elevator gear which was broken and brought to me for repair. Following are the dimensions of the wheel: 4 ft. diameter, 2½ in. thick rim, 3 in. hub, ¾ thick arms. Following is the detail of the operation. Did the following without preheating: First of all I lined my



gear in correct position, then I clamped it down good and tight to my table. I tacked very little A B C D; left E alone; then I welded C, then B, then A, then F, then D. This being done I preheated the rim and hub all around. Then I welded the arm E. This being done I put more charcoal on fire and covered over with asbestos paper until next morning, when I found it O.K. and is now in operation. Hope that this will be helpful to some of my brother operators.

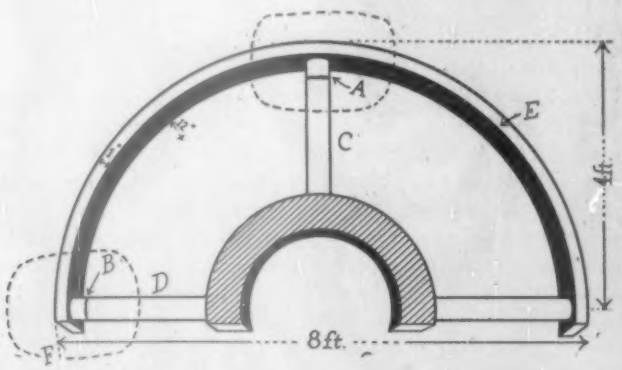
W. B. Manning.

LARGE CAST IRON WHEELS.

Editor: Knowing that a great many welders the country over are having trouble successfully welding large cast iron wheels, especially spokes therein, I will submit an experience of my own.

The wheel, which was only a half wheel, was broken as shown at A and B. When it was attempted to "match" the broken places it was found that the flange had sprung out of round, so the flange was pulled back into place and clamped to the spokes C and D.

The spokes were beveled for welding at A and B, but only on one side, and that nearly through. This was done to save turning the wheel over to weld on the under side. A charcoal fire was built at A and B as shown by the dotted lines. The fire at point A was started enough ahead of the one at point B to allow it to bring the metal to a dull red heat and then be completely welded before the metal at point B could reach a red



heat. The reason for that was this: The flange E resembled a spring with a tendency to pull away from points A and B, with the greatest tension at point B. The fire at A heated the rim of the wheel, lengthening it in the direction of F, an imaginary point. This reduced the tension at both A and B and caused the spokes at A to draw nearer to each other. The spokes at A were then welded clear through to the underside. By this time the charcoal fire at B had the metal at a red heat and it was ready for welding and the weld at A now began cooling off, drawing the ends of the broken spoke at B closer together. B was now welded precisely as at A. As soon as B was welded the charcoal fire was renewed at both A and B and both places brought to a red heat. The casting was moved sixteen miles on an open truck while still very warm but has given entire satisfaction, running 24 hours daily.

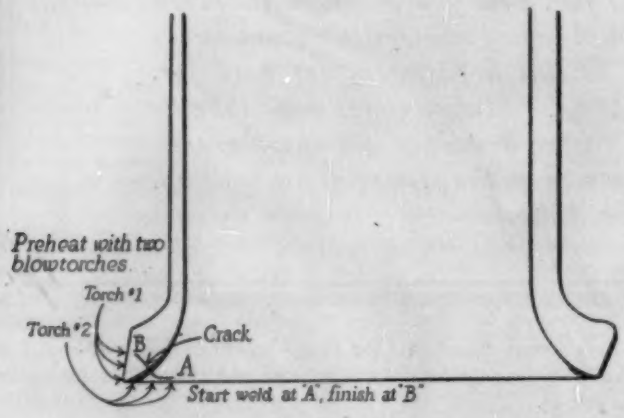
F. E. Lotten.

WELDING MILLING MACHINE BASE

Editor: The inclosed sketch is of a milling machine base which was cracked as indicated.

To weld this base successfully two large blow torches should be used for preheating until red. Start weld at A

and finish at B, keeping both torches on rim for five minutes after weld is finished. This will draw the heat from weld and allow weld to cool gradually, and as welded part is much thinner than the rim of base it is absolutely necessary to keep one torch on the rim from A to B and drawing away from the base gradually until the iron is dark.

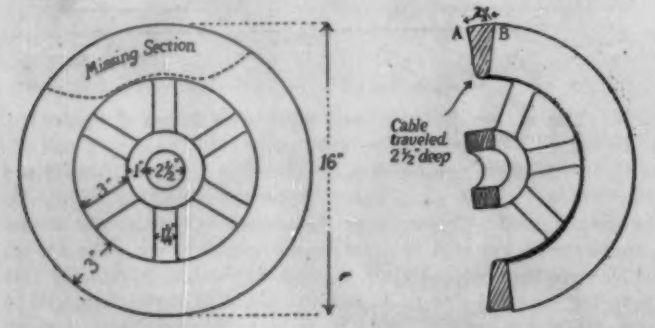


If the rim is cracked on this style of base use one blow torch, preheat where weld is to be made to red hot weld and cover with sand. There is no danger of cracking after welding.

G. A. Raguse.

Editor:

While unloading coal from barges to railroad cars the engineer ran the bucket up too high, breaking a piece out of the rim of the cast iron sheave pulley on the boom end. Another pulley not being on hand, the job was tied up. Coal was needed very badly at another end of the yard and something had to be done in a hurry. The pulley was brought to the shop. The piece broken out could not be found. A form was made from a graphite block to fit the missing piece. The pulley was then put on a coke fire and brought to a cherry red, the graphite form put in place and the missing part filled in with three-eighths cast iron welding stick. The pulley was



then placed on a piece of 4 in. pipe 8 in. high and a light charcoal fire built around the rim. A piece of sheet iron rolled up 16 in. diameter, 12 in. high, was placed around it, but nothing was put on the top. This gave the hub a chance to cool down and the rim was kept hot. It was left in that position for about 20 minutes.

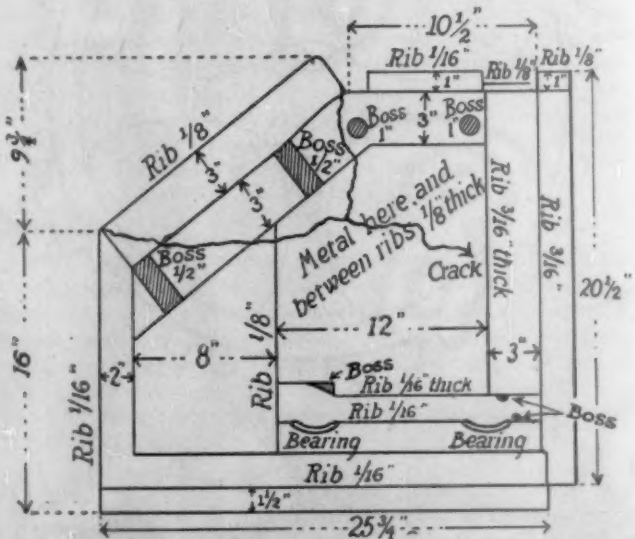
A piece of tin 10 in. x 10 in. was laid on the rim, a ball of waste fastened on the end of a piece of three-eighths rod was dipped in water and squeezed out a little. (The wet waste was always carried across the tin, so no water would drop on the rim or spokes.) The hub was cooled down quite a bit by rubbing the wet waste on it, then the fire was dampened down and a large piece of waste put in the 2½ in. hole in the hub. This piece of waste was kept wet by pouring water on it with a small ladle. In about 15 minutes the fire was then extinguished. The waste made damp and rubbed around the rim and spokes. The hub was always kept a little cooler than the spokes and rim. More attention had to be paid to the hub, as the heat from rim and spokes would radiate into it. By keeping the waste in the hole always wet and rubbing the damp waste on spokes and rim, the pulley was soon cooled down. The piece of 10 in. x 10 in. tin was removed when the spokes and rim were to be cooled and the wet waste was always brought over the pulley at a different place. As there was always a few drops of water falling from the waste, it would soon cool the spot it was dropping on far below the rest of the pulley and it would break. This job has seen service every day for the last year and is still good. I cooled down another one after a welder had broken it through the rim and said it "could not be done."

I would not advise every welder to try it, and I know many will say this is an incorrect method. I did what I tried to do—got the job going again. Welded with oxy-acetylene.

J. E. O'Toole.

WELDING ALUMINUM DOOR AND HOW THE WORK WAS DONE

Editor: In welding this door the work was done as follows: Starting at point A and welding to point C; from C and welding to B; last of all, welding from C to D. Now then in welding from A to C you will notice there are ribs and bosses, which this door was cracked through. Before I go any further I wish to state that this was a cast aluminum door, not sheet aluminum. I welded straight through bosses and ribs as though they were never there. I did likewise from C to B without building bosses or ribs back to their supposed position. Then last of all I



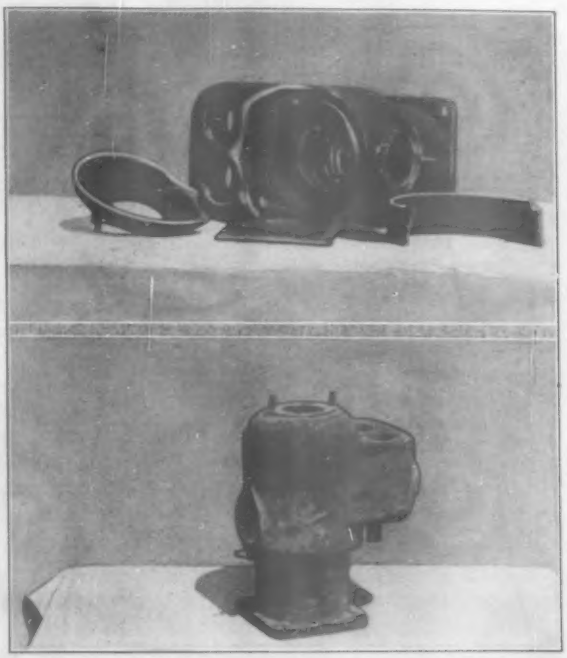
welded from C to D. The reason I worked this way was that there were no ribs or bosses from C to D which gave me clear sailing and at the same time it took care of my contraction. This took me just 1½ hours actual welding time. Then I did nothing to the job until next morning at which time it was perfectly cold. I then built up bosses and ribs and finished the Door. Very little preheating was done. Now if I wished to I could have started at either point without any trouble, for this reason I need very little preheating. If I would have built bosses and ribs as I went along I would have had a peck of trouble. Now I would like to hear from other operators as to how they would do this job. Please answer through *The Welding Engineer* for I think *The Welding Engineer* is the only way we can get a line on such work.

W. B. Manning.

THAT EXPANSION PROBLEM.

Editor: I note your reply to an expansion problem on page 24 of the October issue. I think A is right. I have a theory that all metals grow by means of expansion, being greater when hot than the shrinkage in cooling. Have seen a cast iron pot 24 in. x 24 in. x 16 ft. with 2 in. walls grow 6 in. in six months on the same principle. That is, the length was greater by 6 in., other measurements in proportion.

H. I. Sargent.



Before and After. By H. Weber, of The Weber Auto Supply Co., Colorado Springs.

MAKING GAS CYLINDERS.

Editor: I would like to buy a few 100 ft. and 500 ft. tanks. Can you inform me where I can buy same without signing contracts to recharge? Do you think an ad in *The Welding Engineer* would bring results in second-hand tanks?

L. R. K.

Answer: Every gas manufacturer is looking for early delivery of tanks, we believe. Hardly think you could buy in small lots for early delivery. Have nothing to do with second-hand cylinders. They are dangerous.—Editor.

WELDING THE CHURCH BELL.

Editor: I notice in your November issue an article in regard to welding a church bell, and as the inquiry asks for suggestions, I desire to submit the following:

Bell metal is usually composed of about 80 per cent copper and the rest tin, with possibly small amounts of other metals to produce a certain quality of tone.

Bells of the size referred to, 1,600 pounds in weight, are slowly cooled. These proportions of copper and tin produce a hard, brittle metal, because of the large amount of what is called the delta constituent, which, under the microscope, shows white and brilliant, and which is very hard and brittle. The large percentage of this constituent, which is an alloy of copper and tin, contains approximately 70 per cent copper, and of which therefore bell metal largely consists, makes the bell metal hard and brittle. Any alloy of copper and tin containing this constituent is more or less difficult to weld, not because the metal cannot be united, but because of the fact that the delta constituent is of a much lower melting point than the rest of the metal, so that it solidifies last and melts first.

During the heating of the bell metal by the welding torch, it will be noticed that at a certain point below the melting point of the metal, small beads or globules exude from the surface, and dance around as do drops of water on a red hot stove. As the welding material is added, these globules are absorbed by it. There must therefore be a line in the original material, from which this low melting constituent has been driven out by the heat, and inasmuch as there is nothing to replace it, cavities must be left to replace it near the line of the weld. This, of course, makes the material weaker at this point than elsewhere, aside from any effect due to the change of grain size caused by the heat.

This is readily proven by microscopic examination, and I enclose you a microphotograph showing this damage to the original material.

This microphotograph is of an alloy which analyzes 89.11 per cent copper and 10.76 per cent tin, and the welding material used was the same. The photograph shows the added material on the right, and the original on the left, the line of the weld being at the edge of the small holes. These small holes show where the delta constituent has been boiled out by the heat. It will be noticed that damage decreases as the distance from the weld increases, which would be perfectly natural.

Microphotograph of Alloy. Dotted Lines Show Added Material.

Such an alloy as is mentioned is not suitable, of course, for welding, but was used during a series of tests for certain purposes.

However, no matter what the alloy used, this damage to the original material occurs to a greater or less extent. It can be minimized but not avoided entirely, because the effect is due to the heat. Therefore, I believe it is impossible to weld any copper-tin alloy and get the same strength as in the original material. As a matter of fact, with the best welding material, the breakage of the test pieces always occurred through the line of these holes. I believe that this is the reason for the breakage of the bell in the place referred to, and while it may be possible to make a weld with such material that will last for a while, I am afraid that a permanent repair is out of the question.

I might say in this connection, that while Tobin bronze is very largely used for welding, I have never yet seen a weld made with it that was not more or less porous, although its strength is so much greater than the average

brass or bronze casting, that this does not usually cause trouble. Any usual brass and bronze castings that are welded are designed from a foundry standpoint, i. e., it is made thick enough to cast readily, and this thickness is usually far more than is requisite for strength, so even if the weld is somewhat imperfect, it is strong enough, and as very few welds are examined for porosity, the condition that exists passes unnoticed.

I write this note because of the tendency on the part of all of us who are interested in oxy-acetylene welding to apply the process where it should not be used, and because I realize that the conditions above mentioned are not generally known. I certainly do not want to discourage the use of oxy-acetylene welding, but I do feel that the sooner it is realized that there are conditions under which it is not applicable, the sooner will defective welding cease.

I would also criticize your instructions in regard to chilling the bell in water; such treatment on a bell of this size would probably result in serious internal strains, and inasmuch as such bells are always cast in sand, and allowed to cool slowly, the ordinary cooling in a charcoal fire would be, in my judgment, the only proper method.

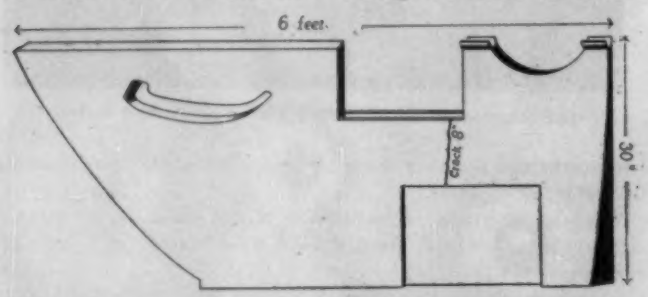
I would also say that I believe heating the bell with a gas torch would produce strains in it, because it is impossible to keep it anywhere near a uniform temperature. I have found that the only way to heat large bronze castings, and we have welded some that weigh as much as 4,000 pounds, is to use a charcoal fire and allow them to cool slowly in it.

S. W. Miller.

WELDING BIG CASTING

Editor: Please find inclosed sketch of a large 1,500 automatic grinder base which I welded successfully in the following manner:

Lay base on flat side and use about 6 bushels charcoal. Spread well around, also inside of frame. Place a few bricks around the outside to keep charcoal and heat on iron, cover with sheet asbestos. Care should be taken not to allow casting to get to a red heat in places. It must be heated evenly all over as near as possible. If the casting is heated red hot in one or two places, it will be apt to crack in some other place beyond the weld when cooling, as I have discovered this fact from previous experience. When casting is almost red all over, start welding on 8-inch crack from



top to bottom, welding through from one side and cover weld with asbestos as quickly as possible.

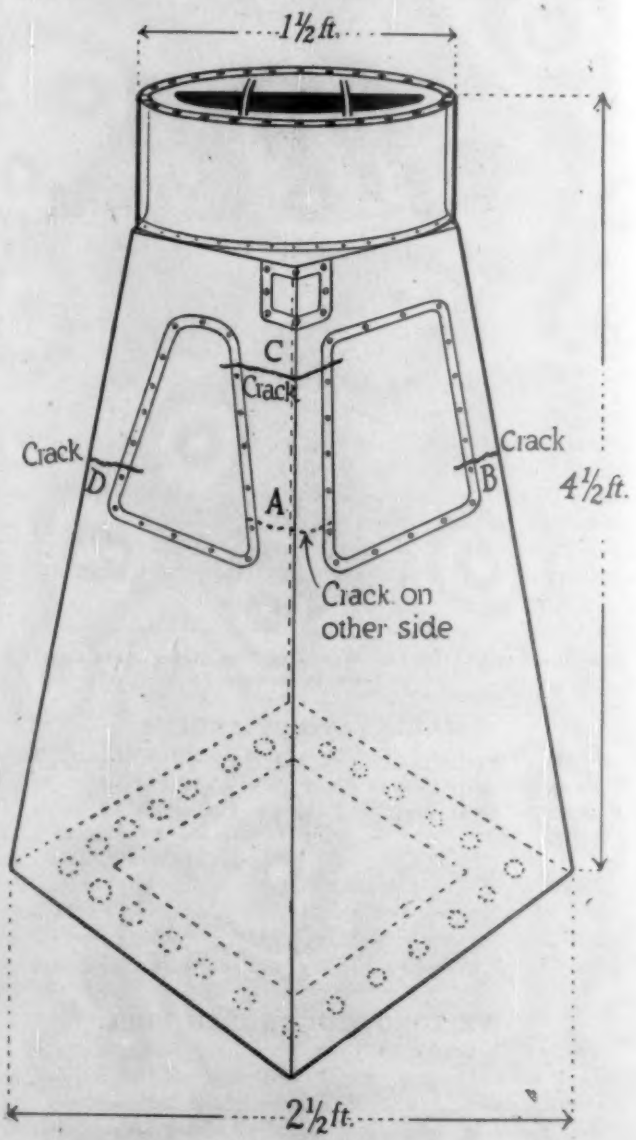
The other side of the same base is quite difficult to weld and I would not advise anyone but an experienced welder to try it.

Now this should be preheated in such a way as to give the best possible results for welding the largest crack first. The base being cracked on both sides near the top, one side had to be welded from underneath, as it is not wise to disturb preheating by turning it over. The crack on the opposite side of this base was not clear through, so I started from the end of crack and welded up to top, taking care not to heat the molten iron too much, as it will flow away from your weld and run off. By keeping a close watch on your flame and iron you can see when the iron is ready to weld. Draw flame away gradually and you will notice the iron run together without flowing away from the weld. Finished job in three hours.

G. A. Raguse, Beloit, Wis.

WELDING ENGINE BASE.

Editor: I am sending a print of a steam engine which is broken in half. I scarfed it with a coal chisel and then I took the crane, set the bottom half on my welding bench, beveled it up and then took the top part and set it down on it. Then I tacked it at A and B opposite one another. Then I layed it down



level and then started welding at C to B to A, to D. Then I built a brick furnace around the parts I welded, leaving about four inches on each side off the weld. I then heated it about red and covered it up to cool slowly.

I would like to thank the gentleman for his correction on the bevel gear, but I would like to tell him that I have never had a wheel come back on me from the process.

A. C. Carlisle.

WHY BAR FORD-CREEPING REGULATORS?

Editor: Having read an article in the November issue, by J. B. Diehl on "Drive Shaft Housings," I would like to ask why he bars the Ford?

Your article on Creeping Regulators, I have had more or less trouble with my acetylene oxygen regulator along that

line. Would it be the best to send it back to factory and have it overhauled?

Answer: Mr. Diehl's article on "Drive Shaft Housings" described a heavier construction than the Ford and it is very seldom that the Ford housing breaks as Mr. Diehl described. As a rule you will find the Ford broken flush with the casting or outside the casting, rarely inside it, so that the method of repair outlined by Mr. Diehl, while perfectly practical for all drive shaft housings of similar construction, is unnecessary with the Ford housing. A much quicker repair in this type is to V out the tube and braze with Tobin bronze, generously adding metal to bond the tube to the casting and building up for at least a quarter of an inch and for a distance three-quarters of an inch each side of the weld.

Regarding creeping of your regulator. There is no particular hazard in the creeping of the acetylene, since the diaphragm is probably strong enough to stand the full tank pressure. But for reasons other than safety, we would advise that you send it back to be repaired. If the oxygen regulator creeps badly, have it looked after at once. You may obtain new seats from the apparatus manufacturer and insert them yourself if you feel competent, but if there is any doubt in this respect, return them for repairs.

Editor.

A USEFUL HINT TO WELDERS ON SHEET STEEL WELDING.

Editor: When welding backs of Auto Coupes, to eliminate buckling, have a man with a pail of water and two rags or waste. Then let the operator start at one end and weld about four inches and stop. Let the helper dip his rag in water and put on the part which is welded. While the helper is doing this, the welder can jump to the other end and weld about four inches. Keep this up until back is finished. Every four inches let helper use both rags, one on top and one on side, until perfectly cold. You will find this a great help to the sheet metal man especially, when he is on piece work.

Reader.

INFORMATION AS TO KEEPING CAST IRON WELDING JOBS SOFT SO THEY CAN BE MACHINED OR FILED.

Editor: I noticed in the November issue of *The Welding Engineer* you were asked by Fuller Brothers for a flux or recipe as to how to keep cast iron soft. Now here is my own 8 years' experiences with welding cast iron and I have welded cast iron castings from one pound to one ton. The art of having casting soft is all up to the opeartor. If he will notice when he is welding cast iron there is a thick skin comes over it. Take your filling rod and keep skimming this off, for welding cast iron you must treat your job as a molder does his metal before pouring in his mold. Skim it, then finish up with little or no flux as possible. If the operator feels as though he is not getting his job as soft as it could be then give it a slow cooling also, and this will help him considerably as to getting it soft. We have jobs which are shaped like an auto tire. Now these are all machined and then must be filed to be finished well. There are small porous holes that show. After filing we weld these small holes shut. Now there must not be the slightest dent in them and they must be soft, so that the filers loose no time, for they are on piece work and they will not touch them. Hoping this information will help Fuller Brothers out of their trouble.

W. B. Manning.

WELDING DREDGE BUCKETS

Editor: We would like to ask you what information you have on the welding of manganese steel dredge buckets? We understand that this work is being done continually at the Panama Canal, and one of our customers has called upon us to weld about a 30-inch crack in a 1-inch manganese steel sheet in a dredge bucket.

Any information that you can give us as to the proper method of doing this work, and references to the other concerns doing similar work, will be greatly appreciated. Since we will be called upon within a very short time to accomplish the weld, a reply at your earliest convenience would be a great favor.

The Metal Welding & Supply Co.

Answer: We have no specific information regarding the welding of manganese steel buckets. We have welded a good many dredge buckets with ordinary mild steel as the filler rod with the best of success and would recommend that you treat the manganese bucket along the same lines, pending criticism from some of our readers who perhaps have done similar work.

A crack two and a half feet long and one inch thick is a job not to be lightly tackled. One thing we would certainly be sure of before we started and that is that the bucket will warrant the expense of welding with the oxy-acetylene flame. The crack may be beveled out with the cutting torch, of course, and it is advisable that you get the line of welding to the red heat and hold it there while welding by other means than the welding torch,—by charcoal, oil or gas torches, for unless you do this you will have considerable difficulty in localizing the heat from the torch sufficiently to bring the one-inch steel into fusion.

Editor.

WELDING A KETTLE.

Editor: I have a cast iron kettle with a crack in the bottom. How should the job be done.

A. E. Heiligenstein.

Answer: Place kettle in fire in position it would occupy when in use. When thoroughly preheated turn on side with crack to fire and weld from inside. This expands metal and opens crack, which contracts when cooling.—Editor.

BOILER WELDING

Editor: I am sending you a sketch of a large sized boiler and would like information at once. The drawing shows operator looking up at patch on fire box end. The marks "o" represent fire crack to rivets, size of patch being 18 in. x 3 ft. Thickness of boiler ⅜ in.

R. B. Sands.

Answer: From your drawing I understand that you intend to weld up an old patch at the crown sheet near the flue sheet.

If this is correct do not attempt to weld the old patch including all the fire cracks as shown in your drawing.

The best method is to cut out the old patch, including the rivet holes, from the crown sheet and put in a new patch made of the same size material.

The patch should be slightly dished so as to take care of the contraction after welding.

Start to weld on the center of the curve and continue so until the end towards the flue sheet. Then follow the other half the same way until completed.—Editor.

CARBON BLOCKS.

Editor:

In your October number you made mention of carbonite used for plugging hole when welding through a hole. Please give me information where I can purchase it.

A. Pool.

Answer: Carbon blocks may be purchased from advertisers in *The Welding Engineer* who sell welding torches.—Editor.

WELDING ALUMINUM AUTO BODIES

Saving in Labor and Material Effected by the Oxy-Acetylene Process

By W. B. Manning

In the palmy days of the horse-drawn vehicle, Amesbury, Mass., was the mecca for the carriage industry. With the advent of the automobile, what was more natural than the development of an industry more in keeping with the trend of the times? The carriage industry in the Amesbury of to-day is to a large extent replaced by factories devoted to the manufacturing of automobile bodies, their products outrivaling in appointments, finish and design the most luxurious wooden coaches of old.

In Amesbury some rather remarkable methods of aluminum body construction have been developed, which have made possible radical departures in design, saving in material through the more economical cutting of patterns, and savings in actual labor costs as well. Oxy-acetylene welding plays an important part in this new type of body construction at the plant of the Walker-Wells Company, a development of the Walker Carriage Company, manufacturers of carriages for more than 25 years.

In the manufacture of the Franklin roadster body, the back quarter panels, consisting of a single piece of sheet aluminum, extending from the door opening on one side around both quarters and across the back, could be constructed in no other way except by welding. The entire section is welded into one solid piece without a seam in about five minutes.

The unpainted Winton Berlin body is another example of the saving effected by oxy-acetylene welding. The top of this body is constructed of aluminum and is welded to the back panel to form one continuous piece. The top, as well as the various other parts, may be made from several plates welded together, which obviates the necessity of using larger sheets of aluminum, thereby reducing the cost and in some cases permitting the use of various small pieces of sheet aluminum that would otherwise become scrap, again effecting a considerable saving. The constructing of a center post panel from four pieces of stock of odd sizes can be welded in less than 10 minutes. The forming of the cowl on Franklin bodies formerly presented many difficulties, due to the large amount of metal that must be formed and swagged over the front to form the front panel. This difficulty has been overcome by the welding process. The cowl can be hammered to shape with very little metal formed over the front with this process. The remainder of the front panel is made up by welding in small side sections or wings, the front panel sections now conforming with the characteristic lines of the Franklin hood. The total length of this weld is approximately 60 inches and the total welding time of both sides is seven minutes. The boot on the Franklin roadster is also welded into one solid piece, the welding time on these two welds should not exceed seven minutes. The same class of work on a coupe rear boot requires a much shorter time, only five minutes, for welding. Welding of this character is carried out with the separate parts clamped to a frame and then welded.

Another operation which formerly presented difficulties in auto body manufacturing is the forming of door panels around the window frame openings. This was formerly handled by slowly hammering the metal over the frame, carefully working in the corners, the process occupying a total time of over two and one-half and sometimes three hours. Even by proceeding slowly and exercising the greatest care in the forming of the metal at the corners, it was found that cracks would appear at various places in the metal, due to the strain of working the metal cold. A considerable loss of material was the result in a great many instances. This difficulty is now overcome by using a small acetylene blow torch, which is similar in principle to the well known Bunsen burner. The metal is simultaneously annealed and hammered by one man. In this case the same cylinder of acetylene that is ordinarily used with the oxy-acetylene outfit is now employed to furnish gas for the annealing and hammering operation. The total time occupied by this newer method is 30 minutes, at a time cost of less than one-fifth of what the old method of hammering cold formerly cost, and with practically no loss.

For the benefit of those who are not familiar with the welding process a detailed explanation of the method of proceeding with this class of sheet aluminum welding will doubtless prove interesting and instructive. In the majority of operations the edges of the sheets to be welded are turned at right angles to a height of from one and one-half to twice the thickness of the metal, after applying a flux to cause the metal to flow freely. These upturned edges are brought together and held with clamps or tongues. A short section of a few inches is then welded. The tongues or clamps which are used are moved a few inches more along the weld and the metal welded to this point. This is continued until the entire section is welded. Often a helper is assisting the welder by manipulating the free ends of the unwelded portion, if there are any, bringing them together as he moves the clamps along the line of the weld in advance of the welding operator. Preliminary tacking of the joint at regular intervals with the welding flame, except at the point where the weld is begun, is not considered good practice, as it has a tendency to cause a buckling of the sheets as the weld progresses, which interferes with the progress of the operator and nearly always results in bad workmanship.

The proper use of a fluxing agent is one of the most important points to be watched in sheet aluminum welding. Its improper application nearly always results in imperfect work. The following information will prove useful to welders engaged on sheet aluminum work. A special sheet aluminum flux, mixed with water to a consistency of cream, is applied to the line of the weld by a stiff brush, similar to a painter's sash tool. After the weld has been completed the flux is washed off either with a scrubbing brush, or as is more commonly the case, with a bunch of waste soaked in cold water, the water being applied freely. It is necessary to

remove all the remaining flux from the line of the weld and the adjacent metal for the reason that practically all aluminum fluxes contain chloride, and aluminum is very susceptible to the action of chlorine, either in the free state or in combination with other elements. This causes corrosion, which may or may not appear until after the body has been painted, when it will cause the paint to peel. Not all fluxes can be used in a wet form, but in the event a dry flux is used, observe the same precaution in regard to removing all traces of the flux applied. It is customary to have a pail of water handy so that the scrubbing may be done immediately upon completion of the weld. Care should be exercised not to "trap" the flux in the weld, in which case no amount of scrubbing would remove it. By "trapping in the weld" I mean the flowing together of the metal in the joint above and below the flux so that the flux cannot be entirely burned out. An advantage in using flux in a moist condition is that when applying the first coat with a piece of cloth both edges of the metal must be rubbed to a distance of about ⅛ inch, which effectually removes any oxide from the surface of the metal and also destroys any greasy material that might form a film over the molten metal. After this is done a second coat should be applied sparingly with the stiff brush. No filling material is used in the welding operation, except at points as a defect may occur, either through the improper handling of the welding flame or lack of a sufficient quantity of flux to allow the metal to flow together freely. In the latter case, usually a narrow strip cut from the same metal is used as a filler, and the operator refluxes the line of weld before starting to fill in the defective spot. After welding, the line of weld is hammered flat under spring power hammers, similar to those used for flat hammer work in all sheet metal industries.

MAKING PRACTICAL BRAZERS AND WELDERS

By C. B. Keemer*

Brazing, welding and cutting are comparatively new in their application to the big businesses of today. As the man who tinkered went from door to door and soldered pots and kettles for the housewife, thus by an inexpensive repair saved the housewife many dollars in that she did not have to buy new cooking utensils, so the brazer and welder goes into the shop of the big business and is able to not only show a big saving in repairing broken down machinery and parts, building up and repairing castings that before have either been returned to the foundry or sold for junk, in the joining of metals of every sort that were previously handled by forges or riveted together, thus the brazer and welder is to the big manufacturer just what the tinker was to the housewife.

Brazing and welding is an accepted part of big business. It is just now finding its place in every shop that in any way handles metals. Brazers and welders are finding no difficulty in selling their services and making a business of learning brazing and welding.

But in this business, like many other new businesses, there has been a big rush to the work and many incompetent workmen have been so costly in their operations, so wasteful in their use of gas and oxygen, that the departments have been a failure because of the waste. The companies distributing the gas and oxygen have seen this gross error and have tried in every way to train men so they could fill the positions that they knew would work with economy for the manufacturer.

There have been a number of schools started in the United States and Canada to train men and they have developed a few good men. Men coming to this profession today are finding that it takes a training with practical experience and a knowledge of metals in order to hold down good positions. These men are deciding that it is best to go where men are trained under the most favorable conditions for this training and that naturally would bring them to the automobile industry, the heart of which is in Detroit.

Brazing, welding and cutting got its start by becoming efficient in the repair of large, expensive castings and it was finally discovered that it was the most efficient means of repairing practically any kind of metal. Then keen sighted manufacturers made careful try outs in different branches of their business and in every case, practically speaking, where it was given a careful tryout it proved a success, and today there is a need for a practical brazer and welder for repairs and new work in practically every metal business and the demand for trained men is practically unlimited. Auto factories are using brazing and welding methods to repair castings which show flaws in them. They use it for joining bodies. They use it in every way that the efficiency expert can show them saving and greater efficiency. Then it goes without saying that the garages and auto repair shops throughout the country find it an essential part of their repair department.

The large steel wrecking plants, bridge and crane companies, companies making tanks and containers of steel, are joining their metals into tanks from the flat sheets by brazing and welding, obtaining a better product with a better looking finish and at a lower cost.

Brazing and welding is finding its way into the steel construction business, both for cutting down parts that need to be taken away because of changes in the architects' plans and in putting up new work.

The large wrecking concerns throughout the country are finding the cutting torches are indispensable, for they can wreck steel machinery and structures in a remarkably short length of time.

One marked advantage when repairing with oxy-acetylene is that the repair outfit may be brought to heavy casting and the repairs made without removing it. Think of the saving in time that this makes in large factories. Think of the expensive operation in removing parts for repairs. If brazing and welding was not the best known plant there would still be a marked advantage in its use.

We went to the factories to learn exactly what was needed and immediately instituted in our brazing and welding department the very things which would train the men to be able to go into these factories and take up the work as though they were moving from one part of the factory to another.

We found that it was necessary to give the men the torch after carefully instructing them in metals and their fusing points, give them a practical theory as well as practical experience. We have found that the men trained in our way have been able to hold positions indefinitely which were open and in some cases the test on new men has been terrific. New men were placed in the shops under new surroundings with a man watching every movement and they were given the most difficult work in brazing and welding to do first, and if they failed did not have an opportunity to try the second time. This method however is being set aside in most places, for the employing departments have found out that many a good man who was capable of doing the work has failed because the surroundings made him nervous.

To the manufacturer who is not entirely familiar with brazing and welding as it might be applied to his business, we would suggest that he is making a grave mistake in not learning about it. The people selling gas, oxygen and equip-

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**Of the Michigan State Auto School.*

ment are employing the best efficiency engineers in the country to assist the manufacturers by an extended service in shortening his manufacturing cost. The manufacturer must know thoroughly either by his own experience or that of men trained in the field that he can use this process and then it is necessary for him to employ trained men, for it is an expensive experiment to use men who do not know their business.

Detroit is the Heart of the Auto Industry. In this industry brazers and welders were first extensively employed. The training of men in this business has been very successful in the Michigan State Auto School for the demand is big and the working conditions have been watched closely.

SAFETY FIRST BULLETINS

The Julius King Optical Company, 10-12 Maiden Lane, New York, has inaugurated a novel method of impressing the importance of eye protection on employers and employes alike. This method consists in the publication of an attractively printed monthly bulletin service. These bulletins are to be posted up in a conspicuous spot where they will come to the attention of workmen and they impress upon the reader, in a very forcible way, the danger which is incurred in exposing the eyes to injury. Every reader of The Welding Engineer will be mailed one of these Bulletins monthly upon request.

WHAT HAPPENED TO AUTO GAS TANKS.

Perhaps the greatest surprise which the average automobile owner could have, by way of upsetting his well settled opinions, is the knowledge of the fact that the Prest-O-Lite gas tank, which was at one time in universal use for automobile lighting, is still an extremely busy article of commerce.

When one sees the large number of electric lights now used on automobiles it is quite easy and natural to jump to the conclusion that electric lights must have dealt the acetylene lighting industry a tremendous blow—an impression which might not be reduced, but rather encouraged, by the fact that the Prest-O-Lite company itself is busily engaged in the manufacture of storage batteries for electrically equipped cars and is extending its national system of service to cover the electrical needs of the motorist.

But as a matter of fact, the Prest-O-Lite gas tank is having one of its largest and most prosperous years. Like the bicycle, which continues to be manufactured in larger quantities than ever, in spite of the fact that the "bicycle craze" was supposed to be over long ago, the gas tank continues to flourish.

An analysis of the reasons will show that this condition of affairs is not at all illogical. There are still large numbers of automobiles using acetylene lighting. Quite a number of motorists who employ electric starting and electric lighting, still prefer to use acetylene headlights. Other motorists find the gas tank a wonderful aid to the electric starter, by using acetylene for priming the motor in cold weather. Then, too, the gas tank has more than held its own on trucks and other forms of commercial vehicles—and there are more trucks being manufactured today than there were automobiles a few years ago.

Perhaps even more important are the many new uses which have been developed for the handy cylinders of gas with which all motorists were formerly very familiar. The same tanks used on automobiles are now being used to operate hundreds of thousands of acetylene blow-torches for soldering, brazing, and a score of other commercial heating purposes.

Large numbers of chemical laboratories where city gas is not available have found a ready solution of their problem of operating Bunsen burners and other heating appliances through the use of Prest-O-Lite gas.

It is used for lighting churches; for supplying footlights and other lights in Chautauqua tent meetings; used with magic lanterns; used for camp cooking and lighting; used for supplying heat through a small hot plate for sterilizing the instruments of country doctors; used for flare lights and spot lights by contractors and railroads; for headlights on small locomotives, inspection cars, and other railroad equipment; for lead burning, for paint burning, and what not.

To illustrate the many new fields which are opening up for this peculiar gas: one of the latest processes of metal plating consists of passing wire through an acetylene flame, molten wire being sprayed in very fine particles upon the object to be plated, by the use of a "metal spraying pistol." With this process, it is possible to plate even a piece of cloth, such as a handkerchief, without burning it. The same process is used by the railroads for spraying bridges with zinc, for the prevention of rust.

And on top of all these rapidly multiplying uses is the enormous field of oxy-acetylene welding and cutting.

Taking it all together, it will be seen that there is an answer, perhaps wholly unexpected, for the man who asks: "I wonder what has happened to the Prest-O-Lite gas tank since electric lights came into use on automobiles."

A UNIVERSAL FLUE WELDING MACHINE

The Southwark Foundry & Machine Company, Philadelphia, Pa., has developed a universal machine for welding flues up to 5½ in. in diameter that is designed to meet the conditions which have arisen since the general adoption of superheaters for use on locomotives. With this machine, it is emphasized, it is possible to take safe ends of greater length than has been the csutom in the past which has introduced the complication of making it necessary to support the end while it is being heated and avoid any unusual movement in the transmission from the heating furnace to the welding operation. This has been overcome by locating the furnace in front of the welding mandrel with resultant savings in time and heat in transferring the flue to the welding machine. Another feature of the machine is the working of the weld on the inside instead of on the outside of the tube.

The machine consists of two main parts, apart from the furnace, the clamping head at the front and the driving mechanism at the back. The former is a single circular casting with four air cylinders mounted on the inside. Metal snap rings are provided for the piston instead of leathers of the ordinary cut type, and the front end of the rods are provided with sectional dies that are clamped to the outside of the flue at the line of the weld. As all four cylinders are connected to a single compressed air line carrying a pressure of from 80 to 100 lb., they operate simultaneously when the valve is opened.

Extending longitudinally through the center of the head is the welding mandrel fitting the inside of the flue. This mandrel is hollow and has four rollers assembled in its body which can be moved radially by inserting a taper mandrel that reaches through the middle of the welding mandrel from the back of the machine. This taper mandrel is operated by an air cylinder which is controlled by the main foot valve that actuates the clamping system. The main mandrel is driven at a speed of 100 r. p. m. through two gear reductions by a 1½-hp. motor mounted on the framework underneath the gearing as shown. The gears employed are of the cut type.

An adjustable platform in front of the welding head supports the welding furnace and gives the proper location for safe ends of different lengths. The welding head is protected from the heat of the furnace by a cast iron tank or water back. The mandrel back of the welding rollers approximates the inside diameter of the flue that is being worked on and supports the weight of the safe end while the latter is being heated and moved to the welding position.

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When the machine is in use the operator stands at some distance from the furnace and uses a foot valve which controls the entire operation of the machine. The piping is arranged so that the clamping heads close in on the outside diameter of the flue before the taper mandrel expands the rollers to make the weld. The mandrel is started by an air chuck operating automatically with the clamping of the flue. Some type of roller table is ordinarily placed in front of the machine to support the flue. With this equipment one crew can turn out 120 superheater flues in a 10-hr. day.

NEW COMMITTEES FOR ACETYLENE ASSOCIATION.

President A. F. Jenkins of the International Acetylene Association has given out a list of committee selections for the coming year. In selecting the members of these committees much care was exercised, it being thought that by enlisting the active services of some able members who have not heretofore taken a prominent part in the affairs of the Association the value of the year's work would be greater. Committee members have previously been appointed year after year, but it is now thought that an introduction of new members on committees will be for the common good.

Committees International Acetylene Association, 1916-1917.

Appliances—G. O. Carter, The Linde Air Products Co., New York; M. M. Lawler, U. S. Gauge Company, 67 Wall Street, New York; Henry Cave, Davis-Bournonville Co., Jersey City, N. J.

Auditing—Rudolph Kirchberger, M. Kirchberger, Inc., 120 E. 27th St., New York; H. F. Reiss, J. B. Colt Co., 42nd St. Bldg., New York; S. H. Walker, The Alexander Milburn Co., Baltimore, Md.

House and Town Lighting—C. W. Kimball, Jr., J. B. Colt Co., 42nd St. Bldg., New York; Fred E. Wood, Ypsilite Mfg. Co., Ypsilanti, Mich.; H. Lee Smith, Wichita Acetylene Mfg. Co., Wichita, Kansas.

Legislature and Insurance—A. Cressy Morrison, Secretary International Acetylene Association, 42nd St. Bldg., New York; E. D. Bullard, 268 Market St., San Francisco, Cal.; F. B. Mueller, H. Mueller Mfg. Co., Decatur, Ill.

Reception and Entertainment—To be appointed.

Portable Apparatus and Marine Lighting—W. A. Cochrane, John Simmons Co., Bldg. 4, Bush Terminal, Brooklyn, N. Y.; R. H. Wells, Badger Brass Co., Kenosha, Wis.; C. H. Carey, John Y. Park & Co., 7th and Cherry Sts., Philadelphia, Pa.; A. V. Connover, American Gas Accumulator Co., Newark Ave., Elizabeth, N. J.

Oxy-Acetylene—R. R. Browning, Oxweld Acetylene Co., Chicago, Ill.; J. G. Hill, Great Lakes Welding Co., Cleveland, Ohio; A. W. King, The Alexander Milburn Co., Baltimore, Md.

Membership—J. T. Earl, Davis Acetylene Co., Elkhart, Ind.; H. S. Smith, The Prest-O-Lite Co., Indianpolis, Ind.; R. A. Shaw, The Union Carbide Sales Co., Chicago, Ill.

Resolutions—Augustine Davis, Davis-Bournonville Co., Jersey City, N. J.; M. Kirchberger, M. Kirchberger Co., Inc., 120 E. 27th St., New York; P. A. Rose, Oxweld Company, Newark, N. J.

Technical and Engineering—J. M. Morehead, Peoples Gas Bldg., Chicago, Ill.; Prof. G. G. Pond, The Pennsylvania State College, State College, Pa.; W. F. Barrett, The Linde Air Products Co., New York; C. K. Bryce, Oxweld Acetylene Co., Newark, N. J.; M. Moskowitz, The Prest-O-Lite Co., Indianpolis, Ind.; Augustine Davis, Davis-Bournonville Co., Persey City, N. J.; P. A. Rose, Oxweld Acetylene Co., Newark, N. J.

TWENTY-FOUR MILES OF STEEL PIPE.

An Opportunity to Use Oxy-Acetylene to Advantage Neglected.—Why?

It is the duty of a trades paper to serve its readers. This service is usually in descriptions of work along their particular interest and in our case of course includes welding and cutting. From the highly esteemed *Engineering Record* which, as the name implies, is devoted to the problems of engineering, we have read with interest, but not with gratification, an article written by Mr. H. A. Rands of Portland, Oregon, who acted as engineer in the construction of a main pipe line of approximately 24 miles to supply with water the cities of West Linn and Oregon City. From an engineering standpoint, the article is highly interesting and therefore appropriate for the readers of the publication in which it appeared. From a welding point of view, the article is disappointing, but we believe we serve our readers in republishing a portion of it with a view of opening up new fields for welding or of ascertaining the objection to welding in this instance.

"Bids were called for on machine-banded wood pipe, lap-welded steel pipe and riveted steel pipe. After opening the bids there occurred the usual controversy as to the best material. The wood pipe was cheapest. Riveted pipe was more expensive and lap-welded the highest priced. The commission at one time voted to award the contract for riveted pipe. This was done despite the recommendation of the engineers, who contended that to build a line of the character and size of the one in question, having thousands of degrees of curvature, both horizontal and vertical, with inflexible riveted joints to be laid out and cut in advance, would be a long and tedious job. Later the vote was reconsidered and the job was awarded to the same bidder for Matheson pipe construction."

It will be noted that the engineers recognized the dangers of riveted pipe, called attention to degrees of curvature and the difficulty of cutting and forming riveted pipe for such work but no mention cited of the ease with which joints may be made on the spot, that is in the field, with the oxy-acetylene torch.

"The pipe on the upper 13 miles has a diameter of 18 in.; on the lower 11½ miles 16 in. pipe was used. The larger size has a thickness of 0.245 in. and the smaller 0.234 in. The preservative used was the usual dipped coating made by the National Tube Company. For 10 miles from the intake the line follows the gorge of the Clackamas River, where there was much rock work. Several tunnels, having an aggregate length of 1,212 feet, were also necessary. Along much of this upper 10 miles the pipe had to be carried across the river from the road on the north bank by means of aerial lines and donkey engines. For this the huge trees were used for cableway towers, and they served the purpose admirably even when the span was as great as 1,000 feet. To the credit of the contractor it may be said that this difficult work was accomplished without a single accident to a workman and with the loss of only one length of pipe. . . . ."

Interrupting the author at this point, we might point out that the pipe used was ideally adapted to welding. With the aid of a cutting torch, elbows could have been practically eliminated, all odd lengths could have been used and there would have been little or no necessity of ordering special lengths.

"At the end of every job there are always a few things which, if it was being done over again, would be handled differently. First among them would be the use of the National burlap coating in place of the dipped coating now on the pipe. Another change would be the exclusion of a few elbows used to negotiate sharp summits. Two of these

(Continued on page 40.)

How Should Welders Be Graded?

Let us assume that welders are divided into four general classes, from an efficiency standpoint, as follows: 1st, Master Welder; 2nd, Class A; 3rd, Class B; 4th Class C. Now what, in your opinion, should a welder know about his trade to qualify as a "Master Welder"? Again, in order to qualify as a Class A welder, what must a welder know about welding not required of Class B and C welders? In other words, what are the requirements and where are the division points?

The Welding Engineer is preparing to conduct examinations and issue Certificates of Proficiency "to welders who may present themselves for examination. Before we announce our complete plan we would like to have opinions from our readers on the subject. We will pay $5.00 for the best opinion received before the January issue is on the press.

L. B. Mackenzie, Editor.

Finding the idea you want—*Quickly!*

If you can't use an idea in THE WELDING ENGINEER in January, perhaps it will repay you many times the subscription price next July.

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Oxy-Acetylene Welding

A Comprehensive Treatise on the Practice of Welding Cast Iron, Malleable Iron, Steel, Copper, Brass, Bronze, and Aluminum by the Oxy-Acetylene Method, together with concise information on the Equipment required for both Welding and Cutting by this Process

By S. W. MILLER

287 Pages, 6 x 9 Inches, 192 Illustrations

PRICE $2.50

Ten years ago the oxy-acetylene method of welding and cutting metals was hardly more than a laboratory process, but in the course of these few years it has become one of the most important of the methods in the metal-working industries. Much has been published relating to this process, but a great deal of that which has been placed on record in the past has been descriptive of odd jobs. It is, therefore, believed that the present volume, dealing in a more systematic manner with the principles and practice of the art of oxy-acetylene welding, will be of considerable value to those engaged in the metal trades.

The information here presented on the subjects of oxy-acetylene welding and cutting has been mainly furnished by S. W. Miller, proprietor of the Rochester Welding Works, whose wide experience in the practical application of the process, and whose success in the work, vouch for the reliability of the information here placed on record. The experience of the author in the oxy-acetylene welding field has been unusually extensive, but having been mostly on repair work, he has written especially for those engaged in a similar line. A great deal of the work done with the oxy-acetylene welding torch is on repairs, and while there are also a great many applications of it in manufacturing work, such applications are more or less special in each case, and sometimes require a great deal of experimenting before success is attained. The general principles here presented, however, apply equally to repair and manufacturing work. This volume describes the equipment required for oxy-acetylene welding and cutting, deals in detail with methods used in welding cast iron, malleable iron, steel, copper, brass, bronze, and aluminum and gives in addition, special attention to the welding of sheet metal, tank welding, boiler repairs, etc., as well as to the subject of lead burning, which is a special kind of autogenous welding.

The book contains twelve chapters headed as follows:

Equipment for Oxy-acetylene Welding.
Preparation of Work for Welding.
Materials and Fluxes used for Welding.
Making Oxy-acetylene Welds.
Oxy-acetylene Welding of Cast Iron.
Welding Steel, Malleable Iron, Copper and Copper Alloys.
Welding Aluminum
Sheet Metal, Boiler, Pipe, and Tube Welding.
Oxy-acetylene Welding of Tanks and Retorts.
General Considerations in Oxy-acetylene Welding.
Lead Burning.
Cutting Metals with the Oxidizing Flame.

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Manufacturing Work for the Job Welding Shop

The growth of the welding industry is along manufacturing lines. To be sure its value in repairing is great and perhaps it is because of its wide scope in salvage work that the manufacturing end has in many instances been neglected.

This department is for the purpose of showing manufacturing uses of welding and quarterly we will pay $25 for the best suggestion received of construction work which may be done by the job shop.

MANUFACTURING WORK FOR THE JOB WELDING SHOP
$50 AN HOUR

Would you consider $25 for a half hour's work sufficient remuneration? It will probably take not longer than 30 minutes to tell us about some little manufacturing welding job and if your suggestion seems the best one printed in three issues, there is $25 awaiting you.

This department we hope to make a real benefit to the job shop, to the workman and to the apparatus and gas manufacturer. The extension of the scope of the industry certainly will benefit all, so simply on the basis of helping yourself, we should receive at least one contribution from you. But the reward is substantial enough to interest even the busiest of welders.

Sit down *now* and write your suggestion. As we stated last month, grammar, punctuation or word construction are not material. We want the idea and it is on that basis that we will award the $25.—Editor.

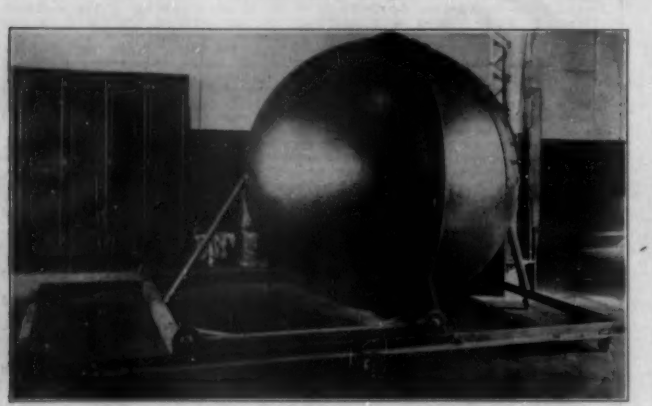


Fig. 1. Welded Photometer.

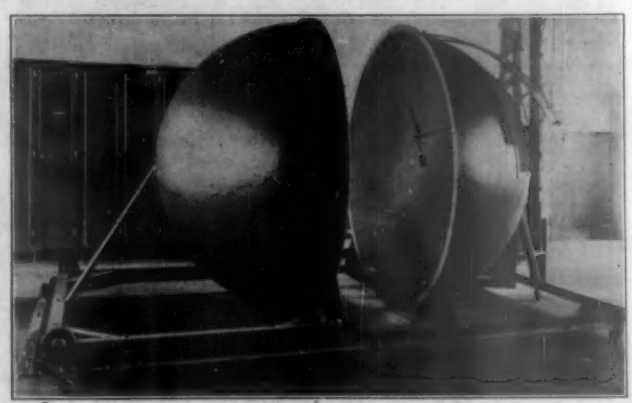


Fig. 2. Two Halves Can Be Separated.

WELDED PHOTO METERS.

By G. K. Jessup.*

An unusual and novel application of the oxy-acetylene welding art has been recently made by Mr. George K. Jessup, superintendent of the sheet metal repair shops of the New York Edison Company, at 41st Street and First Avenue.

Two photometers were built for measuring candle power of electric lights. The first requirement was to supply an 8-ft. internal diameter sphere as nearly perfect as possible. The problem was first undertaken by building a plaster sphere on metal lath, but this would not hold its shape.

The next effort was to make two half spheres of cast iron. It was found that the metal could not be cast of uniform thickness; the weight was enormous and the effort was finally abandoned.

As a final resort the proposition was put up to Mr. Jessup, who promptly made a form representing a one-sixteenth segment of the sphere, made strips of No. 16 soft steel molded over the form and then the flat edges welded together—eight segments shaped like orange peels to each half sphere. See illustration No. 1. Finished weight 350 lbs.

A suitable angle iron flange was riveted to each half to join them. One half was mounted in a stationary position upon a rectangular truck, and the other half was mounted on wheels on the truck, so that it could be moved away from its mate sufficiently to admit the introduction of the largest sized lamps used. See illustration No. 2.

The smaller sizes of lamps are inserted through the door in one of the sections.

The photograph shows the construction very fully.

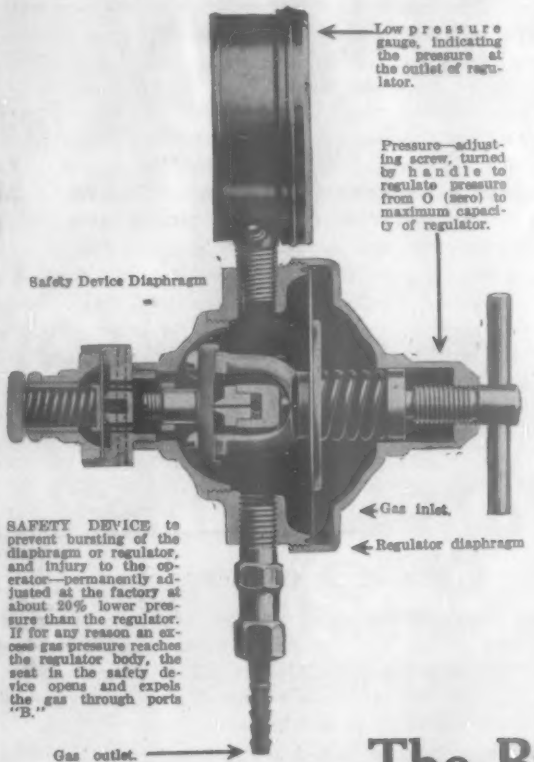
A second photometer was required 40 inches in diameter. This was built by a similar method and is very clearly shown in the accompanying illustration, mounted on welded pipe tripod. (No. 3.) Finished weight 89 lbs.

In order to have the surfaces of these spheres as nearly perfect as possible, the welds were ground with portable electric grinder and the spheres sand blasted inside and out and painted white inside.

Illustration No. 3 shows the operator using Oxweld W4 sheet metal blowpipe with No. 4 tip, with which all the work was done.

The success of Mr. Jessup's application opens up to manufacturers of sheet metal products an enormous field for the

*Superintendent in charge.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substitution of this lightweight material oxy-acetylene welded for a vast number of industrial purposes where heavy

Fig. 3. Mounted on Triped (Also Welded).

cast iron and other more cumbersome materials and expensive methods are now used.

TWENTY-FOUR MILES OF STEEL PIPE.

(Continued from page 36.)

lifted when the line was filled. They were taken out and the profile was revised to eliminate them. Two of the three still in use are anchored in rock; the third has heavily loaded. For negotiating depressions elbows are desirable; on sharp summits they are likely to give trouble. Another change would be elimination of several 16 in. gates put in the 18 in. pipe and several 14 in. gates in the 16 in. line. We have never had occasion to close these gates since filling the line and except for convenience in testing they are of little use. The reason why this is so may be deduced from an examination of the profile. . . . . This gives the high pressure zone a minimum pressure of about 37 pounds."

The author states that the price of Matheson pipe, 18 in. in diameter, was $1.37½ f. o. b. the job; on the 16 in. $1.17. He remarks that the price was extremely low, due to the fact that the purchase was made in the early months of the European war and the dull condition at that time of the steel market and also because of competitive conditions of wood pipe.

That's about all of the story of interest to the welding industry. How much could have been saved on material could probably be determined by some of the wide-awake gas distribution men, who have been laying welded mains for gas under pressure for some five years. Probably it would have been a considerable item. The elimination of threaded or flanged joints for this water supply line, it seems, should be a considerable factor in lessening the cost of upkeep and the doing away with elbows and the speed of the welding process are other factors we should most certainly like to know about.

Perhaps there's some reason why welding in a case of this kind is not used. There can be no question that welding is considerably cheaper, we all know it's a lot better. Gas companies have proven both these facts. There seems to be but little difference in the problems of laying water supply lines and gas supply lines. Why then use welding on gas supply lines and another form of construction on water supply?

Please tell us. Why?

CONTRACTOR USES WELDING.

Having on hand some short pieces of Lackawanna steel sheeting and having use for longer piles, the contractor for the $1,000,000 addition to the Omaha Electric Light & Power Company's plant has made use of the short pieces by welding two of them together at the ends.

The two pieces to be joined are laid end to end on blocking and the welding done with an oxy-acetylene torch. It is said that the welded piles have proven entirely satisfactory. The welds are made by one man in about one hour each.—Engineering Record.

NEW WINFIELD CATALOG.

The Winfield Electric Welding Machine Co., Warren, Ohio, is bringing out a booklet describing the various electric welding processes. The book shows installations of Winfield electric welding machines in different parts of the United States, and gives information and data in connection with spot and butt-welding that will be of interest to manufacturers in general.

The Wisconsin Electric Co., Racine, Wis., has brought out a "Portable Toolpost Grinder." This grinder has an extension spindle for deep internal grinding, lapping out deep drawing dies, etc. The spindle has a reach of 10 inches and is designed to increase the range of the smaller high-speed attachment regularly furnished. Power is transmitted to the spindle through a flexible coupling that eliminates vibration.

NEW K-G CATALOG.

The K-G Welding and Cutting Co., 556 West 34th St., New York, has issued a new catalog describing welding and cutting equipment, regulators, gauges, accessories and supplies. Small folders tell about Oxy-Blaugas welding and cutting supplies and K-G decarbonizers.

The Chicago office of the Henderson-Willis Welding & Cutting Co. has been moved to 710 W. Van Burean St. It was formerly at 2236 Lumber St.

The Burdett Oxygen Co. will complete its new plant at Pittsburgh about Dec. 15th.

The Carbo-Hydrogen Co. of America is building a plant at Cleveland.

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Write for catalog and monthly price list.

The new building being erected by the Imperial Brass Mfg. Co., on South Racine Ave., is nearing completion.

The Turner Brass Works, Sycamore, Ill., has issued a new catalog showing welding equipment.

Stanley W. Winger has been appointed manager of the railroad sales and service department of the Prest-O-Lite Co., Inc., Indianapolis.

PATENTS

A monthly record of patents issued in the United States and which are of more or less interest to the welding industry. It is impossible to give more than a brief description of patents. Persons desiring printed copies of patents may secure same by sending 5 cents to the Commissioner of Patents, Washington, D. C.

Torch (No. 1,204,389). James B. Anderson, Shaler Township, Allegheny County, Pa. Filed Oct. 27, 1915. Serial No. 58,123. Torch is intended for welding purposes.

Acetylene Gas Generator Feeding Mechanism (No. 1,204,016). Horace E. Henwood, New York, N. Y. Filed Feb. 1, 1912. Serial No. 674,651. A carbide to water regulating device.

Acetylene Gas Generator (1,204,015). H. E. Henwood, New York, N. Y. Filed Feb. 1, 1912. Serial No. 674,650. Renewed March 7, 1914. Serial No. 823,246. Carbide to water type for which feeding mechanism above mentioned is intended.

Acetylene Gas Generator (No. 1,204,634). Joseph Zimmerer, Seattle, Wash., assignor to Fred M. Poore, Seattle, Filed Oct. 18, 1915. Serial No. 56,347. Carbide to water type.

Electric Butt Welding Process (No. 1,205,570). Frank L. Sessions, Lakewood, O., assignor to the Standard Welding Co., Cleveland. Edges fused under pressure, burr which is formed being flattened by an igneous blast passed progressively along edges.

Adjustable Welding and Cutting Torch (No. 1,205,195). Herman H. Gumz, Newark, N. J. Filed July 24, 1916. Serial No. 110,897.

Electric Butt Welding Process (No. 1,205,511). Harry E. Butcher, Cleveland, Ohio, assignor to the Standard Welding Co., Cleveland, Ohio. Filed Dec. 22, 1913. Serial No. 808,132. Welding tubing, edges being abutted together under pressure, edges being raised to a temperature short of fusing, fusing being completed by directing a gas flame progressively along edges, following passage of current. Also see No. 1,205,512. Filed April 1, 1914. Serial No. 828,789.

Acetylene Gas Generator (No. 1,205,275). Allen H. Seymour, Bainbridge, Ohio. Filed Dec. 11, 1913. Serial No. 806,041. Water to carbide type.

CLASSIFIED ADVERTISING.

Welders Wanted—Instructors and demonstrators for oxy-acetylene welding and cutting apparatus; requirements—general railroad experience, including boiler repairs. Address Railroad, care *The Welding Engineer.*

Experienced welder for general work; will pay $100 and living quarters to right man; good future, depending on the man. Address Western Welding & Manufacturing Co., El Paso, Tex.

Experienced Arc Welder—Need man who can do boiler work and build up worn places on steel shafts; fill blow holes, etc.; steady job to right man. Address Rhode Island Welding Co., Providence, Texas.

Experienced, all around welder; one who can handle aluminum and electric, as well as others; good job. Address Mathews Welding & Cutting Co., 391 Everett St., Portland, Ore.

Position Wanted—Young man formerly assistant purchasing agent for large manufacturer of electrolitic oxygen plants, wants position anywhere in oxy-acetylene line. Address A. L. Handle, 96 Summer Ave., Newark, N. J.

Wanted—A few good lines of welding supplies, glasses, rods, generators, etc. All must be first class.
Hamilton Welding Co., Hamilton, Ont.

Wanted—Salesman to solicit subscriptions to *The Welding Engineer,* or furnish names of possible readers. Compensation good. Correspondence confidential. Write Mackenzie.

Wanted—Information of present whereabouts of H. Hartzell, formerly of Dashiell Motor Co., Chicago, and later of Davenport, Ia. Address 148, care *The Welding Engineer.*

Wanted: Experienced welder. Paul's Welding Machine Co., Syracuse, N. Y.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

of The Welding Engineer, published monthly at Chicago, Ill., for October, 1916.

State of Illinois, County of Cook—ss.

Before me, a notary public in and for the state and county aforesaid, personally appeared L. B. Mackenzie, who, having been duly sworn according to law, deposes and says that he is the editor of The Welding Engineer, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher—The Welding Engineer Pub. Co., 608 S. Dearborn St.
Editor—L. B. Mackenzie, 608 S. Dearborn St.
Managing Editor—L. B. Mackenzie, 608 S. Dearborn St.
Business Manager—L. B. Mackenzie, 608 S. Dearborn St.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.)

L. B. Mackenzie, 608 S. Dearborn St.

Margaret J. Hungerford, 608 S. Dearborn St.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above, is ————. (This information is required from daily publications only.)

L. B. MACKENZIE.

Sworn to and subscribed before me this 16th day of September, 1916.

[SEAL] HILMA A. HANSES.
(My commission expires December 20, 1919.)

What Would It Be Worth To You To Know—

Control Panel

—That your Welding Plant was no longer dependent upon outside supplies for continuous operation?

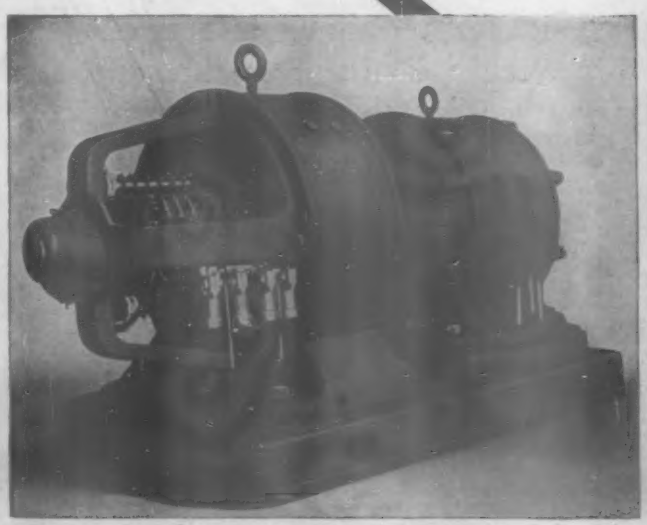
—That when you figured on a job you could do so with the assurance that it would be ready on the date set?

When you install a Westinghouse Arc Welding outfit, you have positive assurance of continuous operation; for the only supply required is electric current—obtained either from the central station, or your own generating plant.

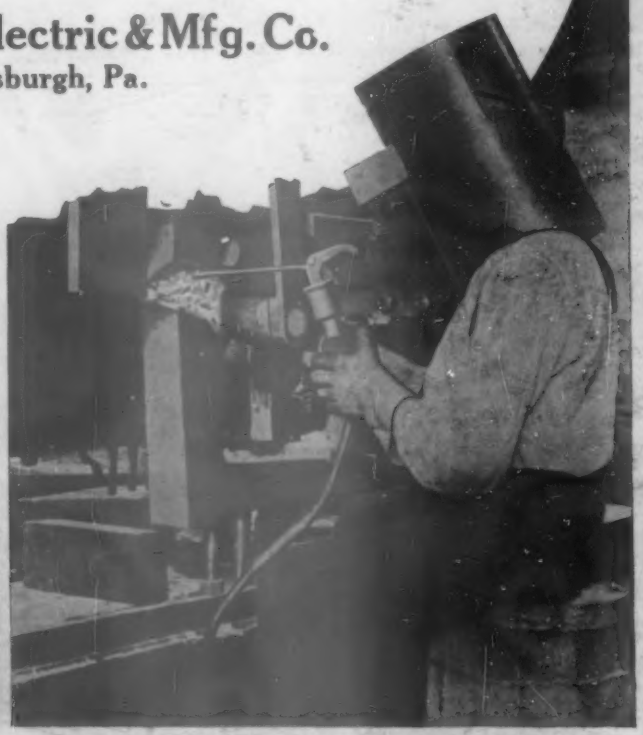
In addition, this equipment will enable you to reduce the cost of welding far below the expense by any other method.

Write for Book 3049-A.

Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.



Motor-Generator Set



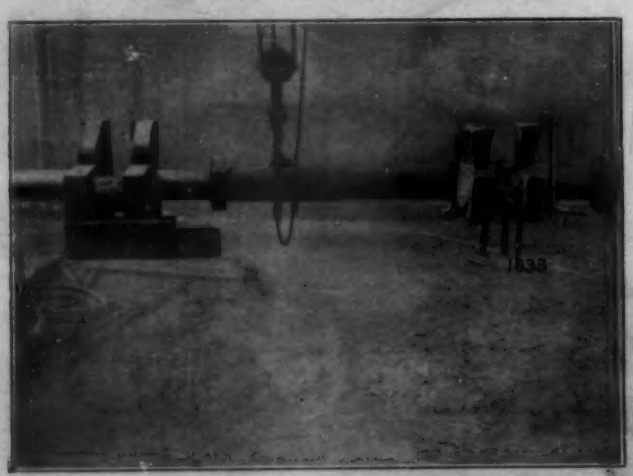
The Welding Operation

Westinghouse

New neck cast on to large roll made with the aid of Thermit and having the pods cast in at the same time.

Large bevel gear on which two new teeth and crack have been repaired.

Four Thermit welds on locomotive frame on the Missouri Pacific Railroad, made without removing the frame from place.



New crank pin welded in by the Thermit Process.

We Are Prepared

To Undertake at a Moment's Notice the Handling of Any Serious Breakdown

Breakage and wear in steel mills and other manufacturing plants has been greater at this time than ever before.

We have been called upon by so many large iron and steel companies recently to make quick repairs to broken rolls and pinions, connecting rods, shears, crank shafts, locomotive frames, and many other sections, the breakage of which often means a serious delay in the operation of the plant, if not a complete shut-down.

Wire or telephone our nearest office and we will proceed at once for arranging the shipment of materials and send an expert to supervise the repair.

We have an eighty-page pamphlet devoted exclusively to this class of work, which is known as pamphlet No. 1779, and tells how the work is executed and how you can do the work yourselves.

Goldschmidt Thermit Co.

William C. Cuntz, General Manager

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